A USERS MANUAL
FOR COMPUTERIZATION
OF HYDROGEOLOGIC DATA
FOR A RIVER ALLUVIUM

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A USERS MANUAL
FOR COMPUTERIZATION
OF HYDROGEOLOGIC DATA
FOR A RIVER ALLUVIUM

By James W. Naney, Bill B. Barnes, and Douglas C. Kent[1]

ABSTRACT

A system for rapid storage and retrieval of data from a multilayered aquifer based on the hydraulic properties of the aquifer was developed. The manual consists of the data-retrieval system, control-card setups and specifications, lists of variables, formats and source listings for data storage and retrieval, and graphical illustrations demonstrating how the system works. Data for the examples were collected in the alluvium of the Washita River near Chickasha, Okla. These data were processed according to the manual to produce a lithologic cross section, an isopachous map, a specific subdatum map, a distributed test-hole-data map, and a permeability-distribution map. The system proved capable of storing and retrieving a large volume of layered hydrogeologic data, and it will have wide geographic application where hydrogeologic studies are undertaken. The system may also be adapted to other types of materials because it uses numerical coding exclusively to describe the hydrogeologic data to be stored, retrieved, and manipulated. KEYWORDS: computerization of hydrogeologic data, ground water, ground-water storage, ground-water transmissibility, hydrogeology, hydrology, lithology, soil permeability.

INTRODUCTION

A layered lithologic system created the need for specialized computer programs to store, retrieve, and manipulate hydrogeologic data. Existing programs (1, 5, 7)[2] would store data on labeled punched cards or provide for the alphameric coding of data on punched cards and store and retrieve ground-water hydrographs. This manual, however, has been developed for the selection and retrieval of ground-water data based on the hydraulic properties of an alluvial aquifer. It documents techniques described in an earlier paper by Kent et al. (3); excerpts from that paper are included here for convenience.

The retrieval system was applied to define boundaries and internal hydraulic characteristics of an aquifer in the Washita River alluvium near Chickasha, Okla. (fig. 1). The alluvium is characterized by several discontinuous layers of silty clay, sand, and gravel similar to those found in stratified alluvial fans, as well as some stratified basin and Coastal Plain sediments. Although the approach used in this study was specifically designed for alluvial aquifer systems, as shown by Naney and Kent (6), it can be used for other similar aquifers.

The computer codes presented in this manual are written in FORTRAN IV for the IBM 360-65 computer. Some of the techniques used for processing the data in the examples were developed on the IBM 1130. A restriction on the word length for coding some of the data was

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[2] Italic numbers in parentheses refer to items in "Literature Cited" preceding appendix A.
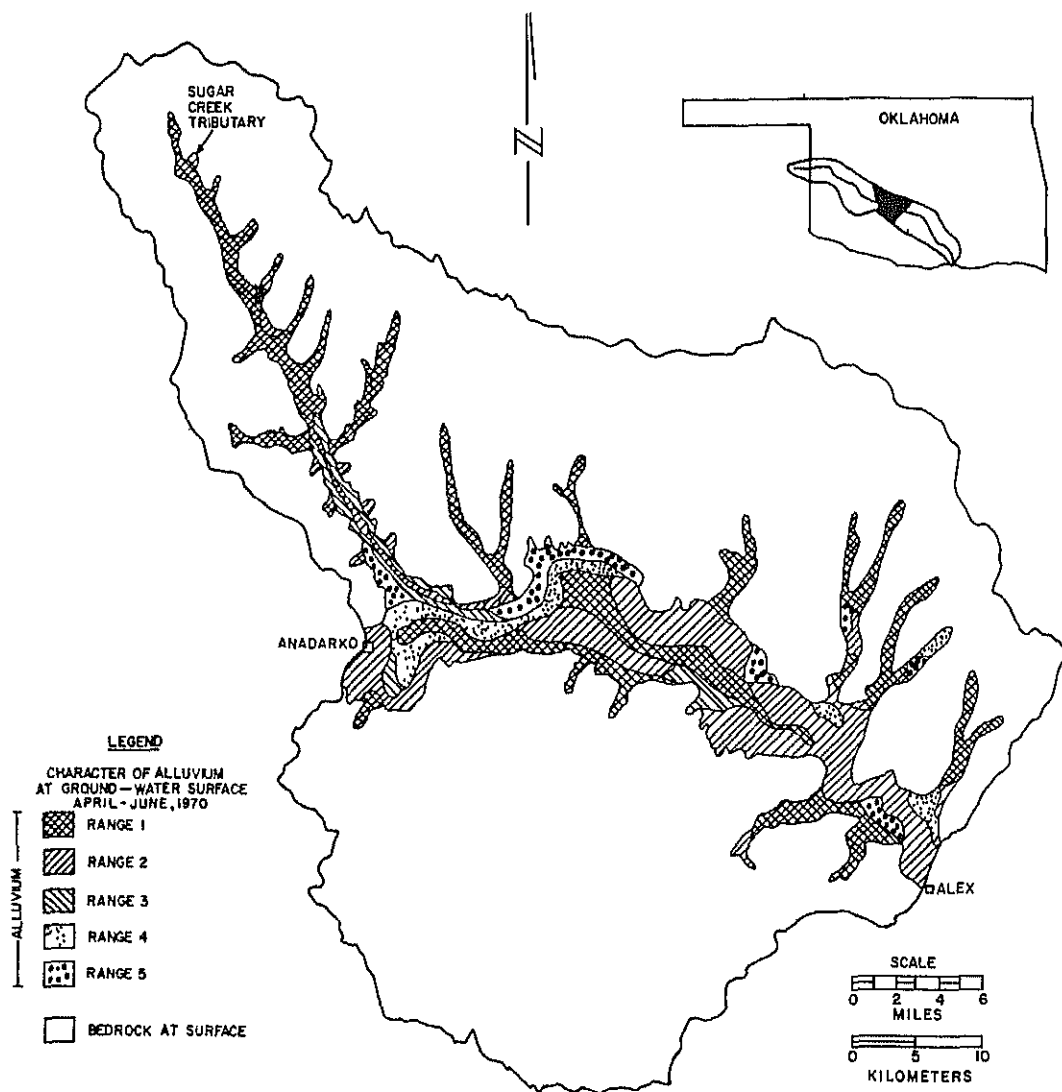
FIGURE 1.—Hydraulic-coefficient ranges in the Washita River alluvium.

encountered with the IBM 1130. The adaption of these programs to both computers, however, has expanded the availability of the technique for which this manual is written.

Three types of data are documented and stored in this data-handling system: (1) general test-hole information (test-hole data); (2) stratification characteristics (layer data); and (3) water-level records (water-level data). The test-hole data consist of the well number, location, elevation of ground surface, elevation of top of pipe (well casing), the number of layers, and the method of drilling. Layer data include layer number and thickness, method of analysis, lithologic type and color, and

approximate range of the hydraulic coefficient for each layer. The water-level data include well number, record type, date, time, and water-level elevation.

DATA-RETRIEVAL SYSTEM

The data-retrieval system (fig. 2) is based on descriptions of the lithology in terms of the type and color of material and of the hydraulic properties associated with each layer. These descriptions are stored by test-hole number, latitude and longitude, and layer number on a disk or magnetic tape. General test-hole information and water-level records are stored

2

FIGURE 2.—Type and function of data processed in computer storage and retrieval system.

3
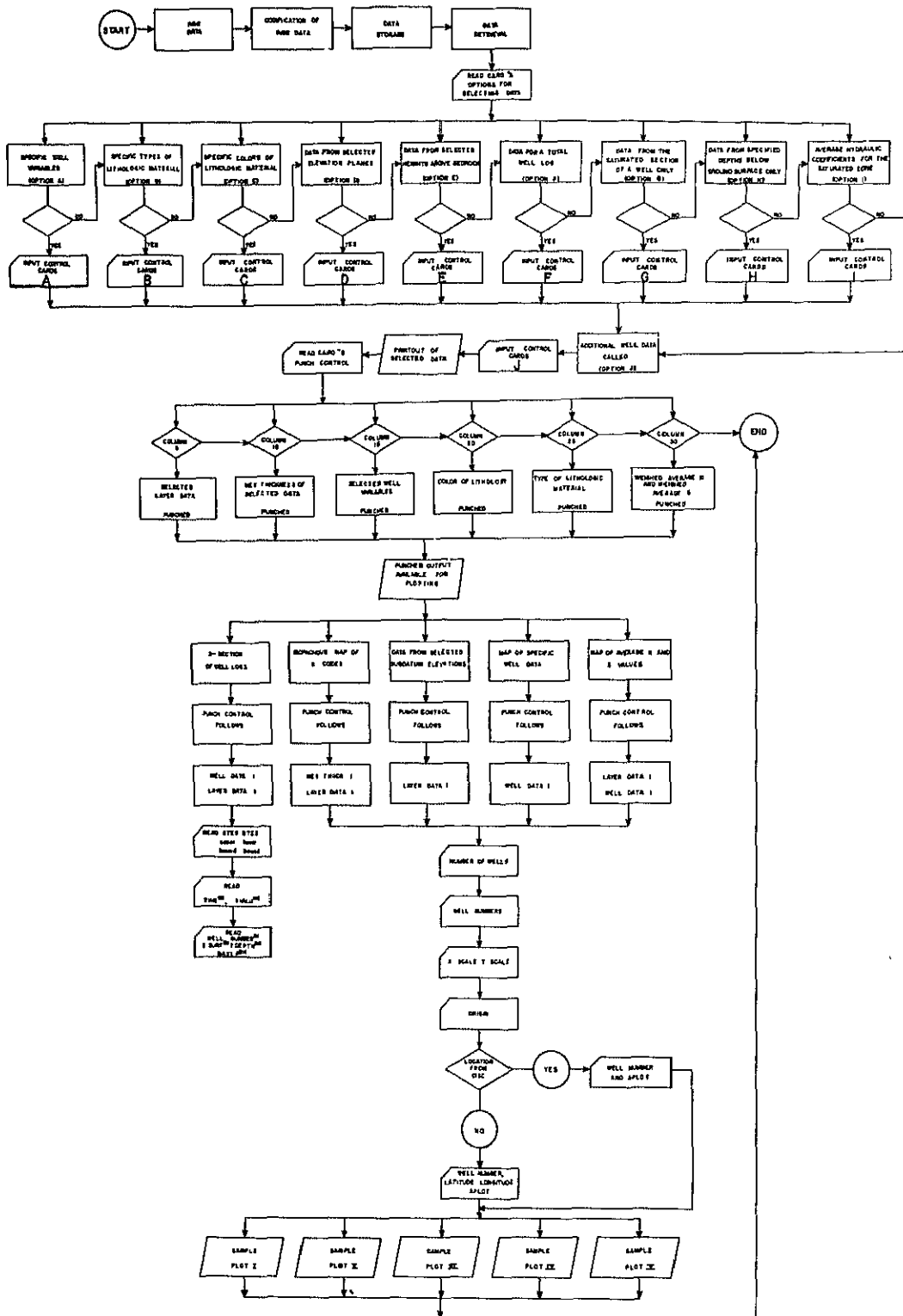
FIGURE 3.—Flow chart for retrieval of hydrogeologic data.

by well number and location on separate disks or magnetic tapes. Specific information related to each of these data is numerically coded and stored by variable number. Combinations of these stored data are used as criteria in the selection of other data or as data that are to be shown graphically.

The hydraulic characteristics of a multilayered aquifer system can be evaluated by options that allow selective retrieval of data. Ten options for data selection and comparison are specified on control cards. A general flow chart of the retrieval program is shown in figure 3. Figure 4 shows how each specific option is selected. Control-card layouts for retrieval options A through J and a description of card types A through N appear in appendix A. The variable name and columns assigned to each code are shown for each option. A list of variable names with descriptions also appears in appendix A. In addition to the options described, subroutine packages may be introduced to be called by specified control cards.

Data-storage format.—The data-storage program reads data from punched cards in the formats shown in appendix B and stores them on magnetic tape. Twenty-one variables are stored for each test hole, including variables that describe the entire well, such as the type of well casing or the elevation of the top of the pipe. These variables are presented in table 1.

Twenty lithologic zones or layers are allowed for each test hole. Currently, no more than 14 distinguishable layers have been stored for any one test hole. There are eight variables describing the lithologic characteristics of each layer, such as layer thickness or the type of material. These variables (table 1) are read from punched cards according to the format shown in appendix B and stored on magnetic tape.

Ground-water levels are stored on magnetic tape for use in conjunction with the test-hole and lithologic-layer data. The format used on punched cards to store the data is shown in appendix B. Storage and retrieval programs for test-hole, layer, and water-level data, along with comments and execution cards, appear in appendix C. The three basic graphical forms produced are test-hole cross sections, lithology-distribution maps, and isopachous maps. A separate retrieval program (not shown in fig-

ure 2) provides data for maps that show the distribution and change in level of the ground-water surface.

Coding and storage of lithologic data.—The lithologic type and color are described with unique combinations of numbers (table 2). Only five numbers representing grain size are used in the code to describe the lithologic type because

TABLE 1.—*Data-processing code for tape storage, entire well*

Variable	Term	Code form[1]
1	Well number or test-hole number	XXXX
2	Watershed number	XXX
3	Location (latitude: degrees, minutes, seconds)	XX XX XX
4	Location (longitude: degrees, minutes, seconds)	XX XX XX
5	Top of pipe elevation	XXXX.XX
6	Ground-surface elevation	XXXX.XX
7	Bedrock elevation	XXXX.XX
8	Total depth of test-hole log (ft)	XXX
9	Distance from logged well to observation well (ft)	XXXXXX
10	Total depth of observation well (ft)	XXX
11	Drilling method	X
	Core	1
	Rotary	2
	Split spoon	3
	Auger	4
12	Casing type	X
	Metal	1
	Plastic	2
13	Casing length (ft)	XXX
14	Casing diameter (in)	XX.XX
15	Screen	XXX.XX
	Screen length (ft)	XX.XX
	Screen diameter (in)	XXX.XX
16	Pump type	X
	Submersible	1
	Jet	2
	Turbine	3
	Centrifugal	4
17	Pump use	X
	Domestic	1
	Irrigation	2
	Experimental	3
18	Pump capacity (gal/min)	XXXX
19	Number of stages	XX
20	Pump diameter (in)	XX.X
21	Number of layers	XX

[1] An X represents a space provided for the variable-number code. A number indicates a specific descriptive adjective to be coded in the space provided for that variable. For example, a 4 put in the space designated by the X after "drilling method" would only select wells drilled by an auger.

START ▷ CARD TYPE A ▷ CARD TYPE B ▷ NWELL* ▷ + ▷ CARD TYPE C ▷ SELECTION OF RETRIEVAL OPTIONS READ FROM CARD TYPE A MADE BY USER

STOP PROG
ō

+ NVAR* ← CARD TYPE F ← + NUM* ← CARD TYPE E ← LVAR I* ← CARD TYPE D ← LVAR*
ō   ō   ō   ō

CARD TYPE G ▷ IDAT* ▷ ō ▷ INC* ▷ + ▷ 4 ▷ CARD TYPE K ▷ SUBDA= 00 ← CARD TYPE J ▷ ICOND* ▷ +
              +   ō   ō
              2   3   3   2

KTEST IS TOTAL NUMBER OF HYDRAULIC COEFFICIENTS USED ← LIST IS TOTAL NUMBER OF LAYER VARIABLES CALLED ← CARD TYPE I ← + ← ICOE* ← CARD TYPE H
ō

KTESK* ▷ + ▷ CARD TYPE L ▷ KTESS* ▷ + ▷ CARD TYPE M ▷ 5 ▷ SUBROUTINE CODE WRITES TABLE OF OPINIONS SPECIFIED
ō   ō

CONT 1 OF 2 ← SUBROUTINE COLOR TEST FOR MAJOR AND MINOR MATERIAL TYPE ← YES ← CARD TYPE I ← SUBROUTINE MATRL TEST FOR MAJOR AND MINOR MATERIAL TYPE ← YES ← CARD TYPE H
                                                        NO   NO

*/ VARIABLE READ FROM CARD TYPE A

FIGURE 4.—Flow chart for

of computer storage limitations. The codes are stored by lithologic layer in the computer. Two primary or one primary and one secondary constituent describe each lithologic layer. These data are also reduced to a form that can show the hydraulic properties (coefficients) of the aquifer.

The lithologic type and color are based on log descriptions made in the field. These logs need to be interpreted accurately before the data can be standardized and stored as layer data. For analytical interpretation of test-hole logs, samples are taken from holes cored adjacent to formerly drilled test sites. Grain size of each core sample is visually described and analyzed for comparison with descriptions based on drill cuttings. The median grain size is equivalent to the grain size having the highest percentage of occurrence in the drill-cutting sample and is termed "primary constitutent." A grain size representing a smaller percentage of the sample is labeled "secondary constituent." With these comparisons and terms, quantitative relationships can be transposed into

CONT 2 OF 2

LIST = NUM = + LVAR =   Ō

NVAR =

RETRIEVES TEST-HOLE DATA

WRITES OUT TITLES AND TEST-HOLE DATA

RETURNS FOR OTHER CONTROL CARD SETS   YES

BACK TO START

NO

GRAPHICAL OUTPUT CALLED   NO

END

YES

PUNCH CARDS ARE INPUT TO USER'S PLOT PROGRAM

WRITES TITLES

RETRIEVES LAYER DATA AND INITIALIZES SUBDATUM SEARCHES

IGSUB *   Ō

IF CARD TYPE J   YES

NO

ILVL *   Ō

INITIALIZES INCREMENTAL SEARCH BELOW GROUND SURFACE

SUBROUTINE WATLV COMPUTES WATER-LEVEL ELEVATION (READS CARD TYPE N)

KSAT *   Ō

INITIALIZES SUBDATUM SEARCH USING CARD TYPE J

K AND S VALUES AVERAGED IN SATURATED ZONE ONLY

K AND S VALUES AVERAGED FOR TOTAL TEST HOLE

ILOG *   Ō

WRITES OUT ONLY LAYER VARIABLES SEARCHED

WRITES OUT ALL LAYER VARIABLES

retrieval control cards, A - N.

terms for coding the visual description of drill cuttings.

Hydraulic properties of the aquifer are determined by using a relationship between grain size and the hydraulic coefficients (fig. 5). The hydraulic coefficients (the coefficients of permeability and storage) are based on field-pump tests of selected alluvial material, laboratory tests of the core samples, and grain size-specific yield relationships (2). The hydraulic properties are coded by dividing the primary and secondary grain sizes into four identifiable ranges (table 3). Undifferentiated sand is included in a fifth range.

A computer program (appendix D) is used to assign a range number (1-5) to the layers of each well on the basis of the coded lithologic description shown in table 4. Hydraulic-coefficient values representing these ranges can be arbitrarily selected from a graphical relationship similar to the one shown in figure 5. The grouping technique makes them applicable to all drill-log data, with only the values represented by each code being subject to change

TABLE 2.—*Data-processing code for tape storage, stratigraphic layers*

Variable	Term	Code form[1]	Variable	Term	Code form[1]
1	Layer number	XX	3	Type of material—Continued:[2]	
2	Layer thickness	XX		Log-description adjective	X
3	Type of material:[2] *column 1*, number of primary constituents (zero if unknown); *column 2*, code of primary constituent; *column 3*, code of adjective for primary constituent (zero if primary constituent has no adjective); *column 4*, numeral 1 if second primary constituent or secondary constituent has no adjective (zero if no secondary constituent), or code of secondary constituent if it has an adjective, or code of second primary constituent with adjective; *column 5*, code of second primary constituent with no adjective or secondary constituent with no adjective (zero if no second primary constituent or secondary constituent exists), or code of adjective for secondary constituent, or code of adjective for second primary constituent.	XXXXX		Very fine	2
				Fine	3
				Medium	4
				Coarse	5
				Lime	6
				Dolomite	7
				Halite	8
				Fossiliferous	9
			4	Color of material: major color is the left digit, minor color the right digit (a zero in either place indicates no color).[3]	XX
			5	Analytical method	X
				Visual accumulation tube	1
				Sieve	2
				Driller inspection (field)	3
				Microscopic examination	4
				HYDRAULIC COEFFICIENTS[1]	
			6	Transmissibility (T) (gpd/ft)	X
				Values from 0 to 8,000	1
				Values from 8,000 to 30,000	2
				Values from 30,000 to 80,000	3
				Values from 80,000 to 150,000	4
	Constituents	X	7	Permeability (K) (gpd/ft^2)	X
	Clay	0		Values from 0 to 80	1
	Silt	1		Values from 80 to 300	2
	Sand	2		Values from 300 to 800	3
	Gravel	3		Values from 800 to 1,500	4
	Sandstone	4	8	Storage coefficient (S) (dimensionless ratio)	X
	Carbonate	5		Values from 0.0000 to 0.0001	1
	Shale	6		Values from 0.0001 to 0.0009	2
	Evaporite	7		Values from 0.0009 to 0.0020	3
	Undifferentiated alluvium	8		Values from 0.0020 to 0.0040	4
	Undifferentiated bedrock	9			

[1] An X represents a space provided for the variable-number code. A number indicates a specific descriptive adjective to be coded in the space provided for that variable.

[2] For example, a log description of a primary and a secondary constituent as "medium sand, with some fine sand" results in a code name of "sand, medium, with some sand, fine," or a number code of 12423. Again, a log description of two primary constituents as "medium sand, and fine sand" results in a code name of "sand, medium, and sand, fine," or a number code of 22423.

[3] For example, a sample with a major color of red but no minor color would be coded 20, one with no major color but a minor color of red, 02; a sample with a major color of red and a minor color of brown would be coded 25, one with a major color of brown and a minor color of red, 52. A code of 00 indicates no color at all was recorded.

[4] Code numbers 1–4 represent a range of values for T, K, and S.

based upon the geological materials being investigated.

Retrieval of lithologic data.—Data can be retrieved in many forms, but the most useful are cross sections and maps that define aquifer boundaries and the horizontal or vertical distribution of the hydraulic properties in the aquifer. The schematic diagram of the retrieval system (fig. 6) shows the assignment and use of the ranges and corresponding estimated values of the hydraulic coefficients for presentation in different graphical forms. Retrieval and testing of test-hole, layer, and water-level data are essential to provide information necessary for selection and plotting of specified ranges of the hydraulic coefficients (fig. 2). Retrieval of test-hole data provides information necessary for selection and plotting of the ranges at a specified depth or subdatum elevation. Water-level data are used to select ranges characteristic of each layer within the saturated zone. Testing on the range number of the hydraulic coefficient permits the selection of specified ranges of the hydraulic coefficients.

TABLE 3.—*Lithologic type and associated range of the hydraulic coefficients*

Range[1]	Lithologic description of log[2]
1	Silt;[3] silt with some very fine sand; very fine sand with some silt; silt and very fine sand.
2	Very fine sand; very fine sand with some fine sand; fine sand with some very fine sand; very fine sand and fine sand.
3	Fine sand; fine sand with some medium sand; medium sand with some fine sand; fine and medium sand.
4	Medium sand; coarse sand and gravel; medium sand with some coarse sand and gravel; coarse sand and gravel with some medium sand; medium and coarse sand.
5	Undifferentiated material in ranges 2, 3, and 4.

[1] Zero is used when a range cannot be assigned to a layer.

[2] Combination of primary and secondary constituents that are classified as indicated.

[3] Silt and clay are undifferentiated.

TABLE 4.—*List of codes representing four groups of relative permeability*

Clay and silt (1)		Sand					
		Very fine to fine (2)		Fine to medium (3)		Medium to coarse (4)	
10000	20011	12211	22211	12324	22324	12500	22524
10011	20012	12311	22311	12423	22423	12524	22425
10012	20013	12011	21122	12300		12425	23125
10013		11122	21123	12400		13000	23124
	20017	11123	22223	12413		13012	22513
10017	20019	12200	22322			13125	
10019	23010	12300				13124	
10125	21010	12223				12513	
10124	21012	12322					
10123	21013						
10122							
12210							
12310							
12410							
12510							
12010							
13010							
11000							
11010							
11012							
11013							
11017							
11019							
13011							
16000							
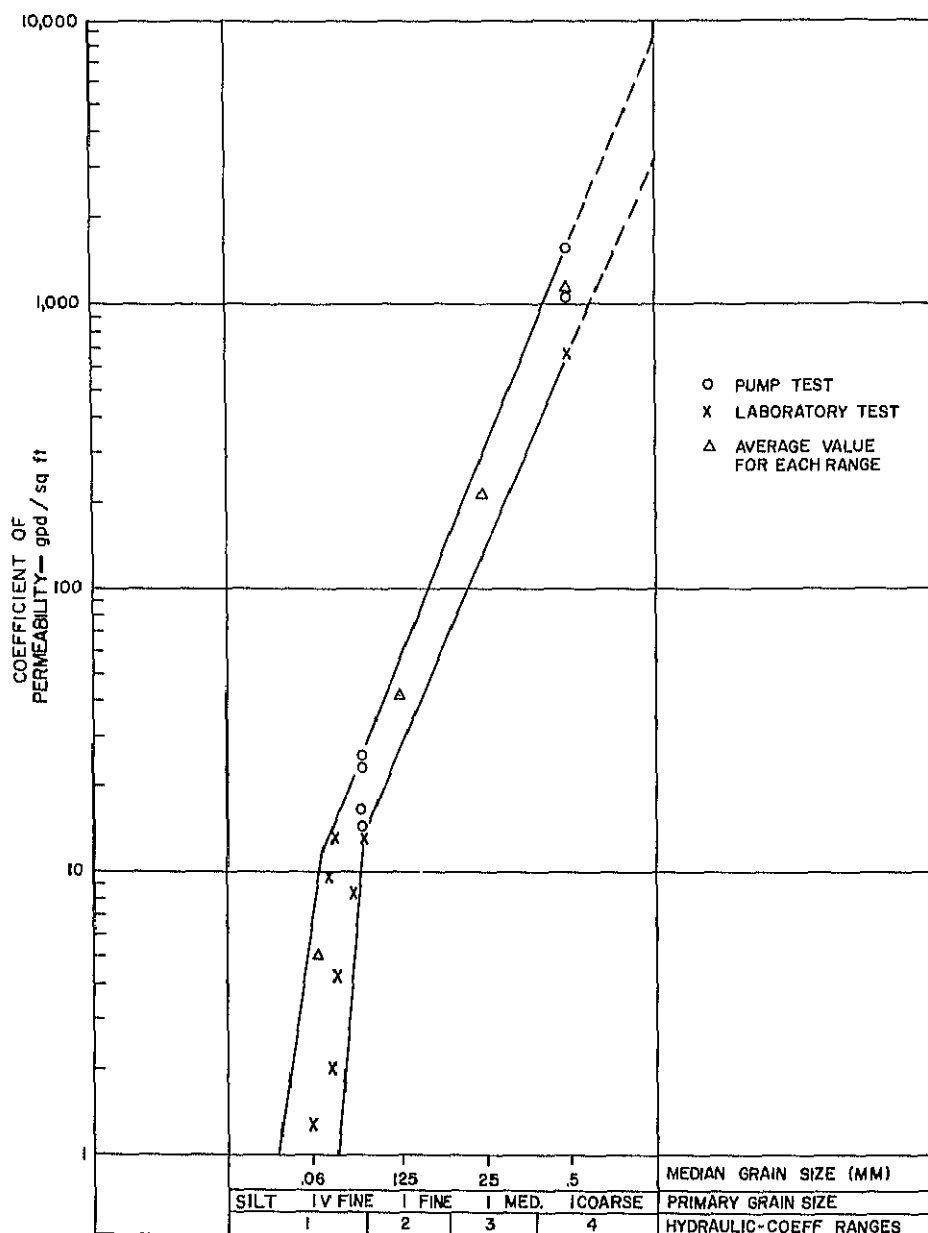
FIGURE 5.—Relationship between hydraulic-coefficient ranges, median grain size, and the coefficient of permeability.

One important aspect of the retrieval system is the use of water-level records for selecting data in the saturated zone. A subroutine which computes a weighted average of all measurements within a selected time period is used to determine the average elevation of the ground-water surface in each well.

GRAPHICAL PRESENTATIONS

Examples are given of five basic types of graphical presentations of data retrieved. One cross-section display and four possible map-view displays are shown. A flow chart of the steps followed in preparing graphical displays and the list of variable names, with descriptions, used to plot selected data are shown in appendix E.

Cross sections of drill-hole logs.—Drill-hole data are punched on cards and may be used as input data for plotter programs. The control-card setup required to retrieve data for the plotting of cross sections is shown in figure 7.

10
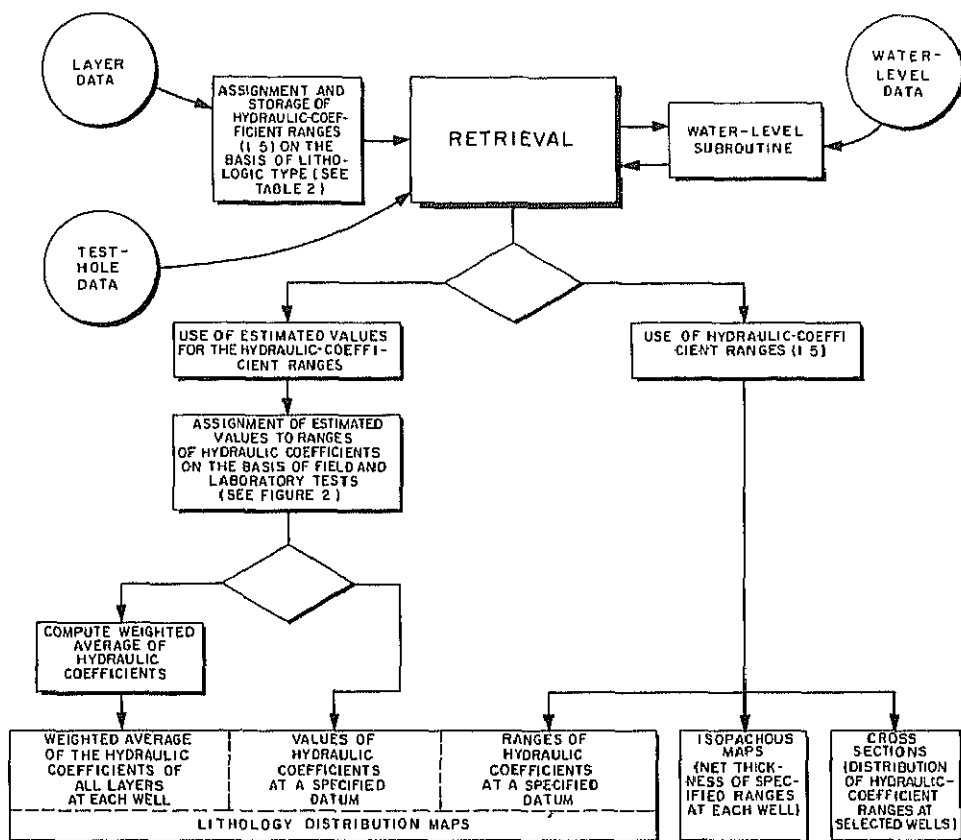
FIGURE 6.—Data-retrieval system using hydraulic coefficients.
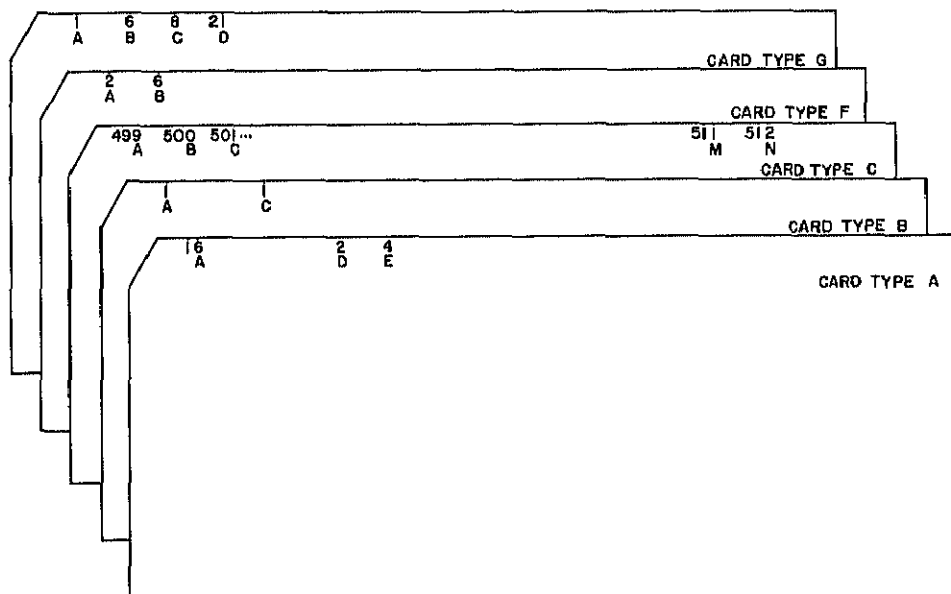
FIGURE 7.—Control cards for retrieval of data for plotting cross sections.
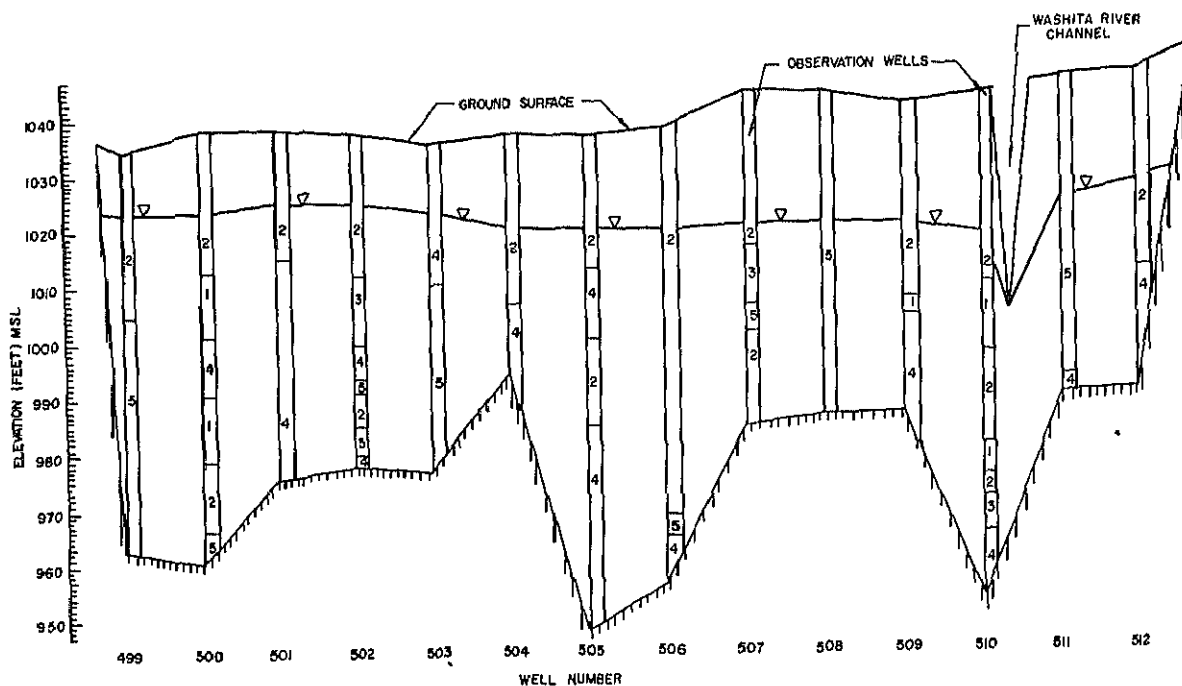
COMPUTER PLOT OF PERMEABILITY RANGES
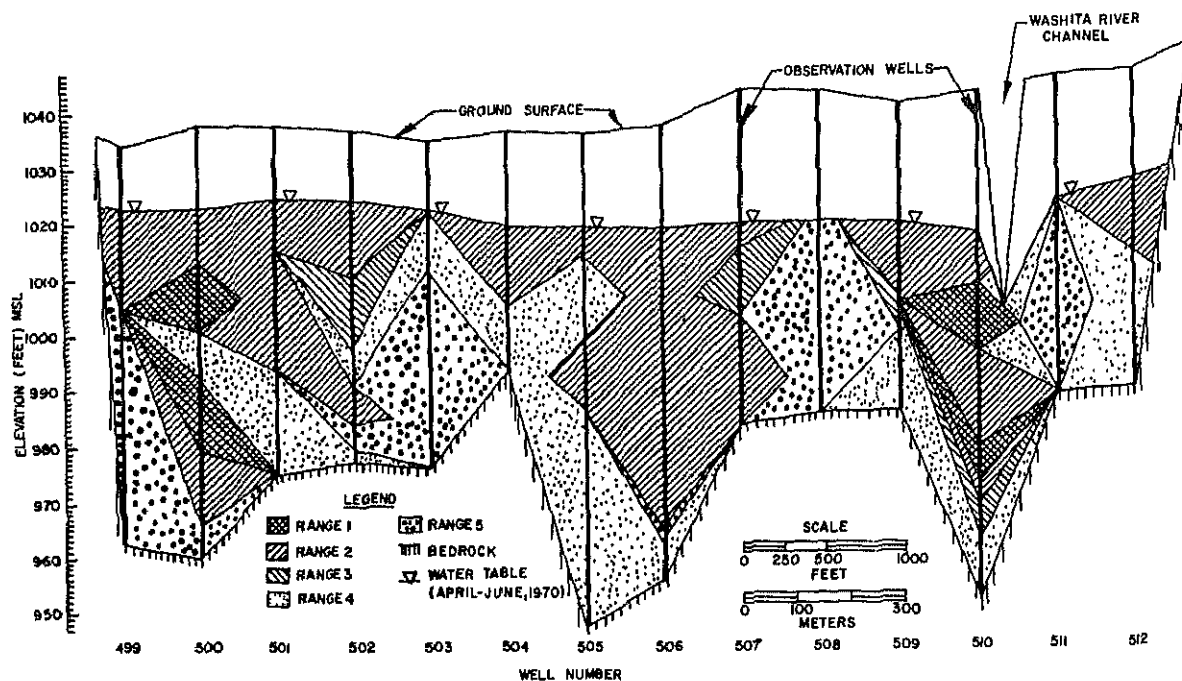
INTERPRETED CROSS SECTION FROM COMPUTER PLOT
FIGURE 8.—Cross section near Alex, Okla.
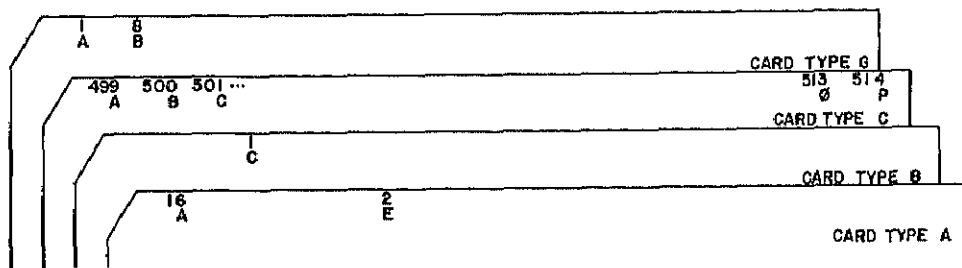
FIGURE 9.—Control cards for retrieval of data for mapping distributions of selected hole data.
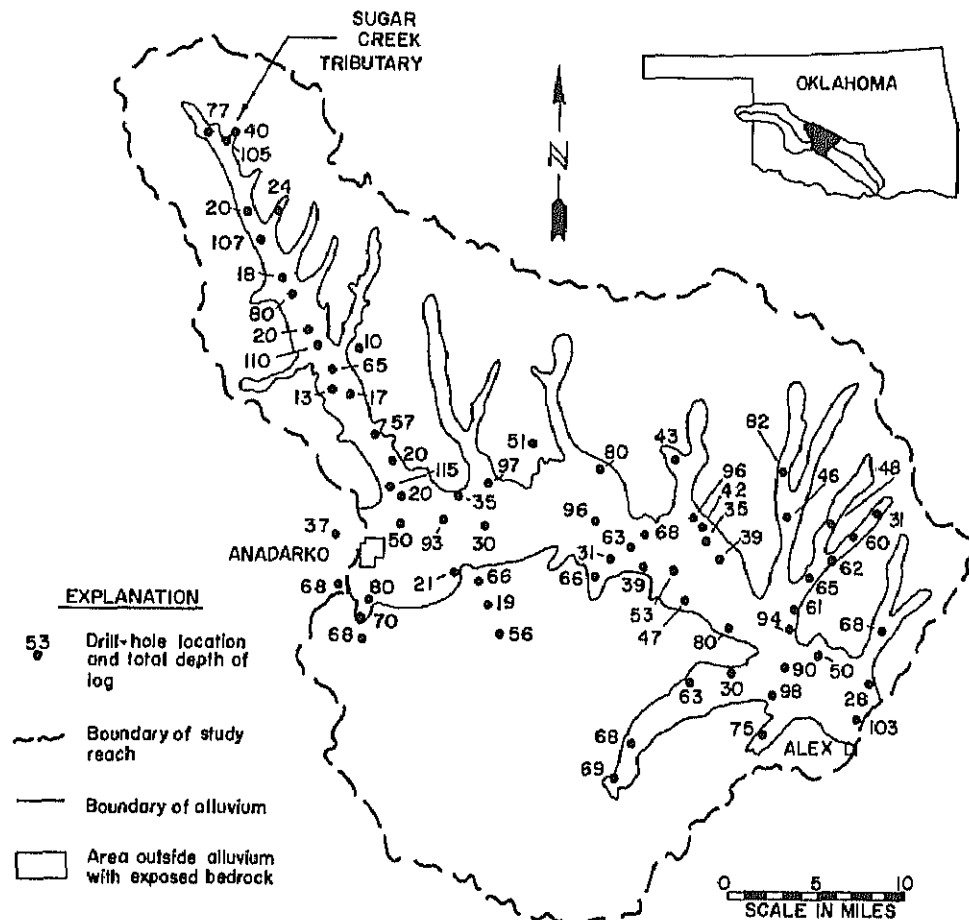
FIGURE 10.—Distribution of total depth of test holes.

For plotting options available, a description of each retrieval control card used is found in appendix A.

A plotted cross section of drill holes near Alex, Okla., is shown in figure 8. Appendix F shows the data cards used to plot cross sections. The variable name, type of plot, and column in which each variable is coded are shown for each card. These data may then be used on the plotting equipment available to the user.

Maps of distributed drill-hole data.—The total depths of the test holes were plotted as a distributive map. The control cards for the plotter program are listed in figure 9, and a map showing the distribution of the total depth of each test-hole log appears in figure 10. The map shows the depth to which lithologic data are available, since some test holes were not drilled to bedrock. Appendix F contains the data cards used to plot selected data maps, with
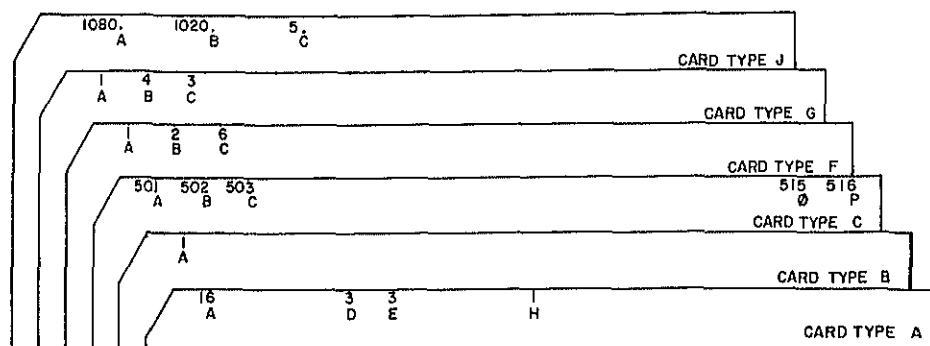
FIGURE 11.—Control cards for retrieval of hydraulic-coefficient ranges at a specified subdatum.
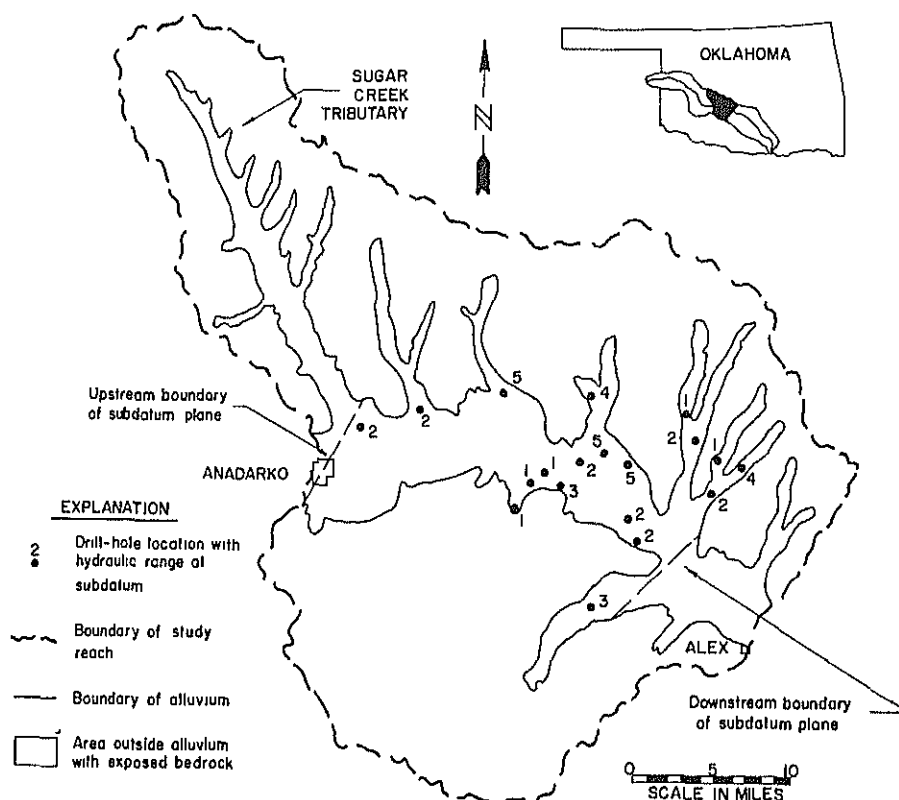
FIGURE 12.—Map of hydraulic ranges for a specified subdatum elevation.

the type of plot, variable name, and column containing the variable code indicated. Any of the 21 test-hole variables may be retrieved for plotting as a distributive map. Appendix E gives a list of variable names and their descriptions for all example plots.

Maps of data from specified elevations.— Because hydrogeologic data concern information that must be gathered at some depth below the surface of the ground, a convenient method of looking at various levels, or subdatum eleva-

tions, was developed by the authors. Digital computer techniques are used to develop a planar surface of lithologic data for a specified elevation above mean sea level. Figure 11 shows the control cards for the subdatum searching. A map of the test holes that have lithology with hydraulic coefficients ranging from 1 to 5 at the specified subdatum is presented in figure 12. Appendix F contains the data cards needed to plot the map shown in figure 12.
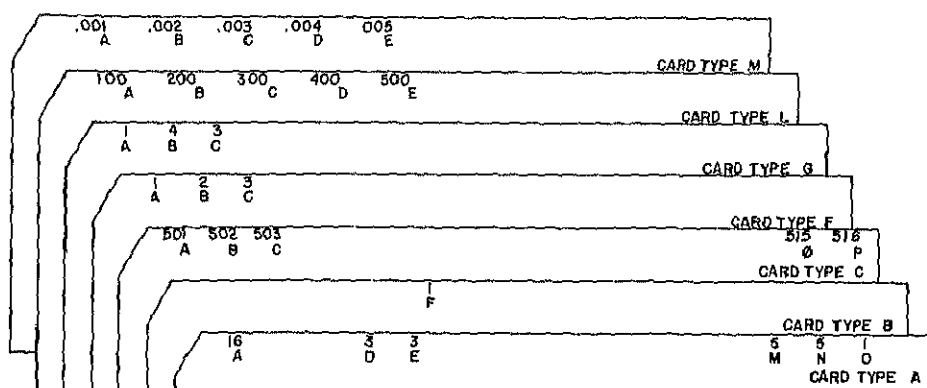
FIGURE 13.—Control cards for retrieval of weighted averages of the hydraulic co-efficients of all layers in each hole.
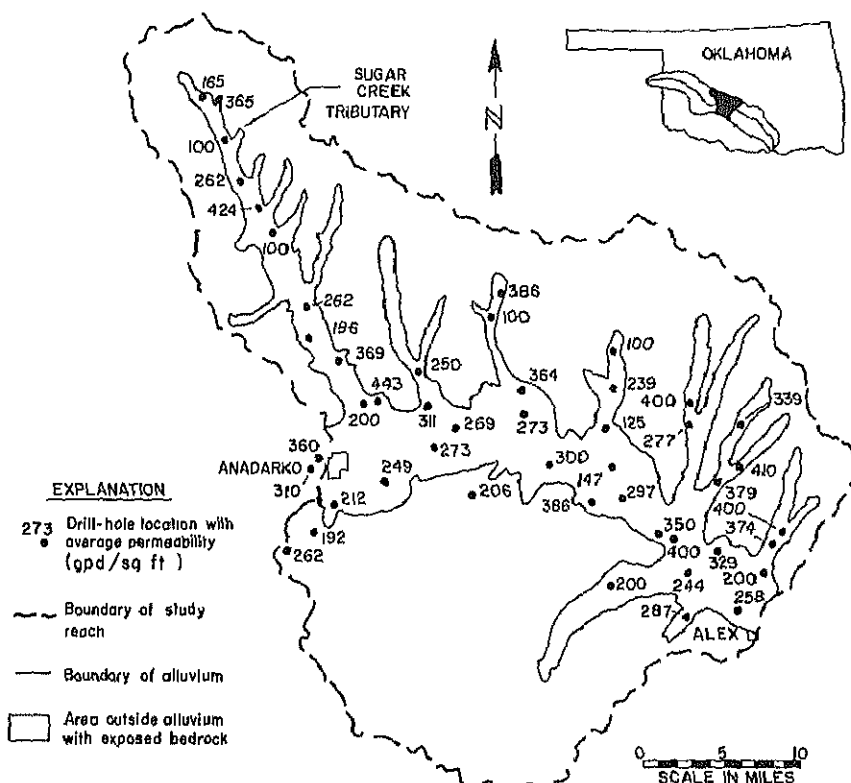
FIGURE 14.—Map of average permeability coefficients.

Maps of average coefficients of permeability and storage.—When the ground-water flow through a specified cross section or the amount of ground water stored in a region of a watershed is needed, it is sometimes desirable to average the coefficients of permeability and storage of the layers that the test hole penetrates. Figure 13 shows the control cards for averaging these hydraulic parameters.

Those averaged values of K (permeability), when displayed in map view (as shown in fig-

ure 14), provide a distribution of test holes that are potentially high or low in ground-water yield. A distributive map of S (storage co-efficient) may be produced using the system. It is possible to determine suitable well field locations and possible artificial recharge areas using areal maps (fig. 1) developed from the distributed test-hole data.

The retrieved data cards used to plot the map shown in figure 14 are presented in appendix F.

15
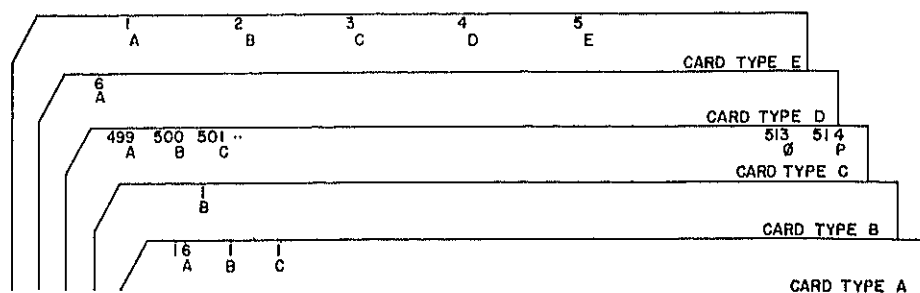
FIGURE 15.—Control cards for retrieval of an isopachous map of lithology having permeability ranges 1–5.
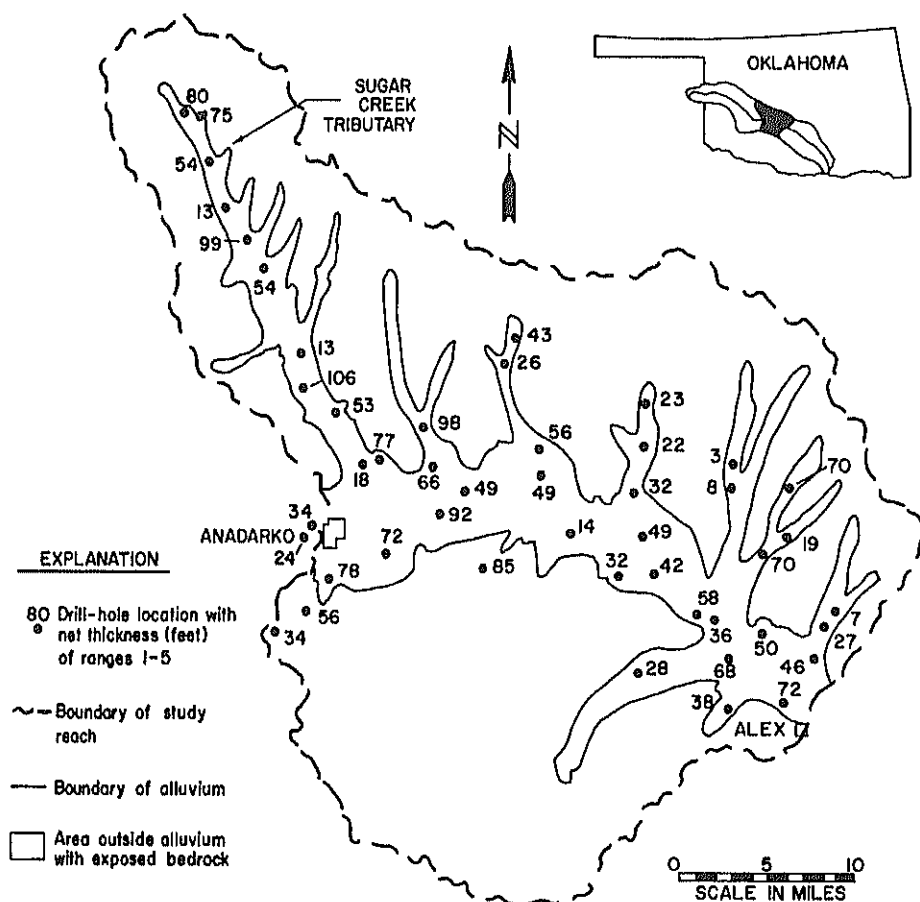
FIGURE 16.—Isopachous map of hydraulic properties, ranges 1–5.

Isopachous maps of specific hydraulic properties.—An isopachous map of all the lithologies within an alluvial system having the same hydraulic properties was also plotted. Such a map is used by planners when well fields are being installed or augmented. The amount of ground water available in an area may be determined from such a map (*3*).

A control-card setup for retrieving data for an isopachous map of all subsurface materials having a hydraulic code 1–5 is presented in figure 15. The isopachous map plotted is shown in figure 16.

Appendix F shows the retrieved data cards used to plot the map shown in figure 16.

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APPENDIX A.–CONTROL-CARD SETUPS, CARD SPECIFICATIONS, AND LIST OF VARIABLES FOR OPTIONS A–N

Control-Card Setups
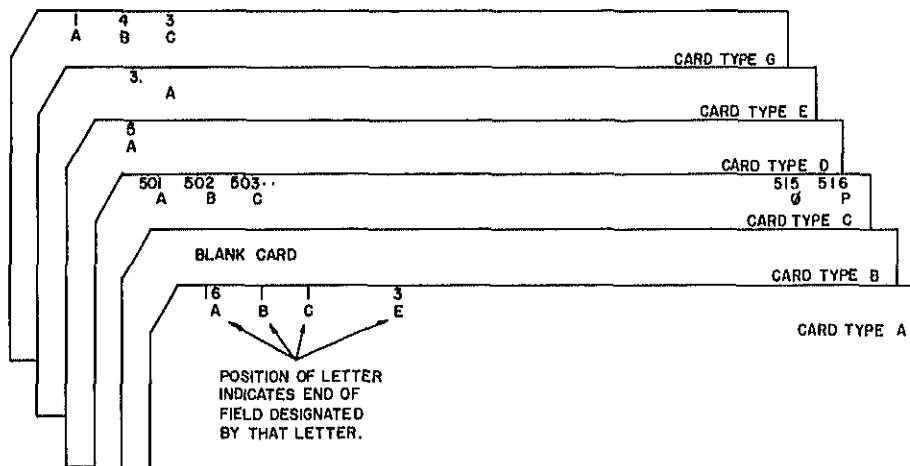
FIGURE A–1.—Retrieval option A: special drill-hole data.
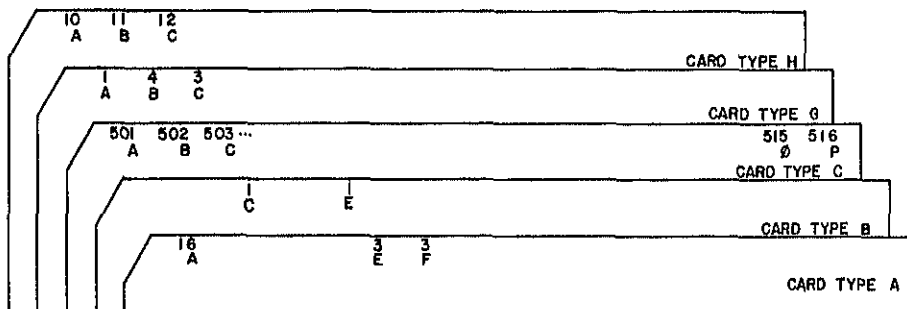
FIGURE A–2.—Retrieval option B: type of material.

17
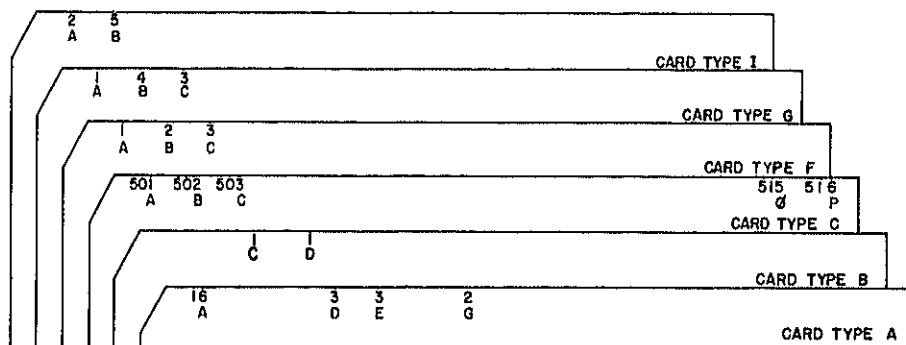
FIGURE A–3.—Retrieval option C: color of material.
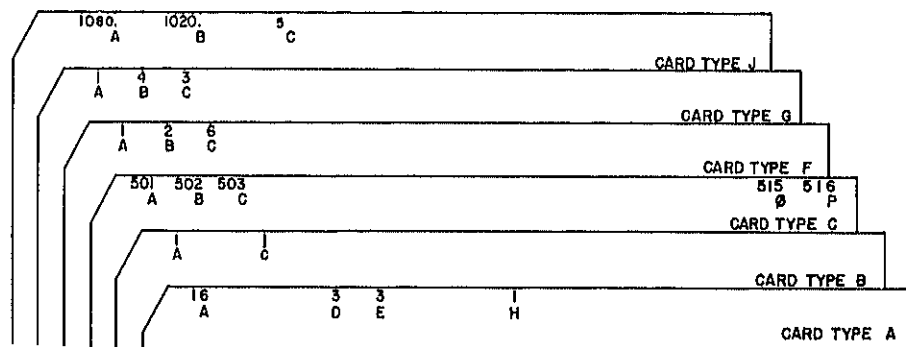
FIGURE A–4.—Retrieval option D: data from specified subdatum planes.
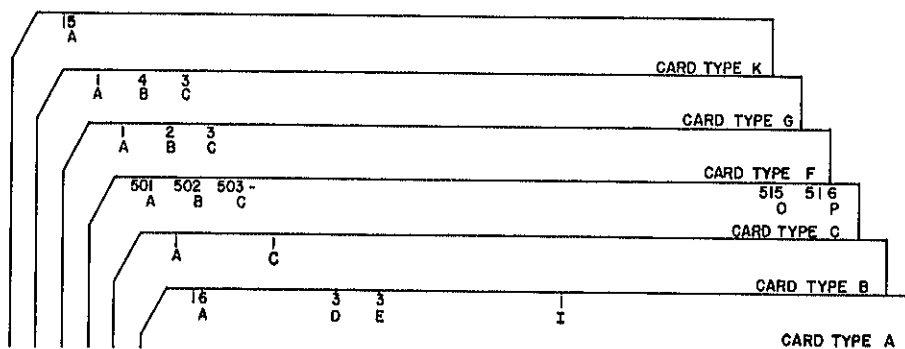
FIGURE A–5.—Retrieval option E: data from selected heights above bedrock.
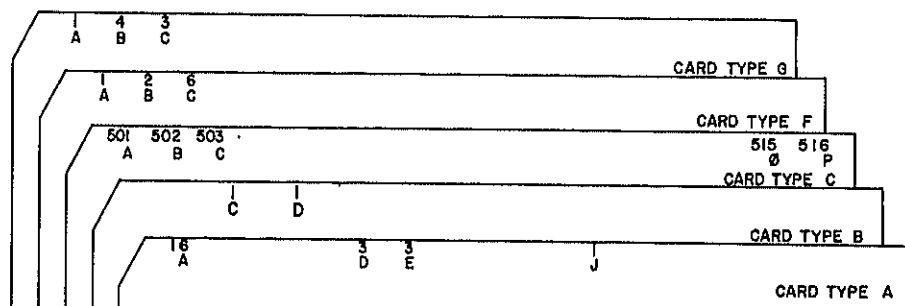
FIGURE A–6.—Retrieval option F: data for logging a test hole.
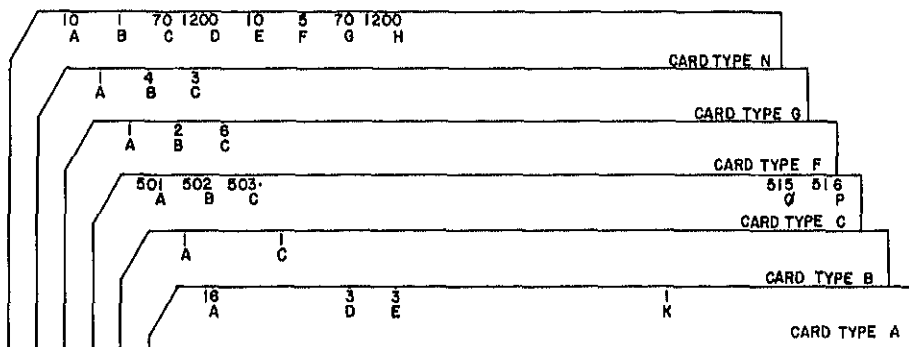
FIGURE A-7.—Retrieval option G. data from saturated zone.
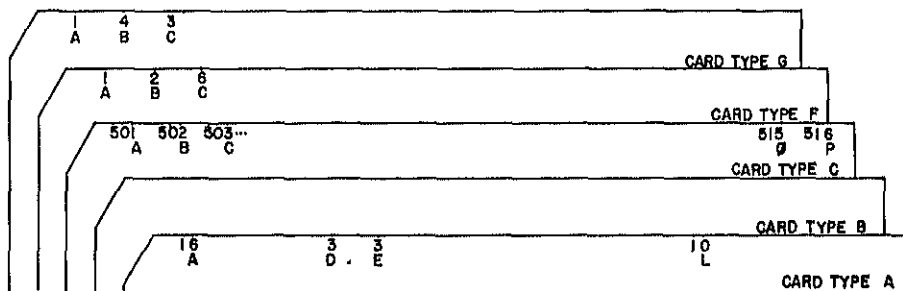
FIGURE A-8.—Retrieval option H: data from specified depths below ground surface.
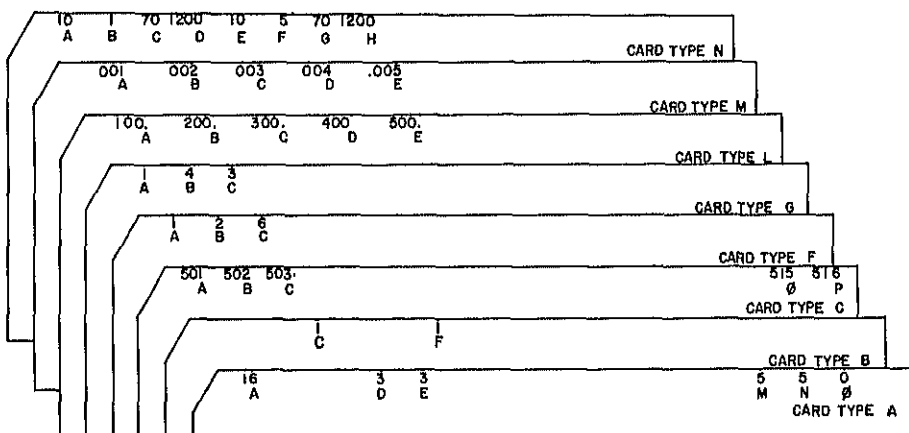
FIGURE A-9.—Retrieval option I: average hydraulic coefficients for the saturated zone.
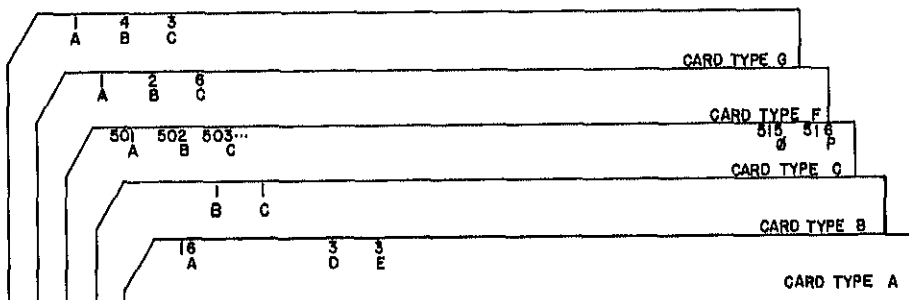
FIGURE A-10.—Retrieval option J: selection of all test-hole and layer data.

Card Specifications text

Card Specifications

CARD TYPE A

VARIABLE OPTION / COLUMN	NWELL 1-5	LVAR 6-10	LVARI 11-15	NUM 16-20	NVAR 21-25	ICOND 26-30	ICOL 31-35	IDAT 36-40	INC 41-45	ILOG 46-50	ILVL 51-55	IGSUB 56-60	KTESK 61-65	KTESS 66-70	KSAT 71-75	
A	X	X	X		X											
B	X				X	X										
C	X			X	X		X									
D	X			X	X			X								
E	X			X	X				X							
F	X			X	X					X						
G	X			X	X						X					
H	X			X	X							X				
I	X			X	X								X	X	X	
J	X			X	X											

CARD TYPE B

VARIABLE OPTION / COLUMN	IPUNH(1) 1-5	IPUNH(2) 6-10	IPUNH(3) 11-15	IPUNH(4) 16-20	IPUNH(5) 21-25	IPUNH(6) 26-30
A						
B			X		X	
C			X	X		
D	X		X			
E	X		X			
F			X	X		
G	X		X			
H			X			
I			X			X
J			X			

CARD TYPE C

VARIABLE OPTION / COLUMN	IWELL(1) 1-5	IWELL(2) 6-10	IWELL(3) 11-15	IWELL(4) 16-20	IWELL(5) 21-25	IWELL(6) 26-30	IWELL(7) 31-35	IWELL(8) 36-40	IWELL(9) 41-45	IWELL(10) 46-50	IWELL(11) 51-55	IWELL(12) 56-60	IWELL(13) 61-65	IWELL(14) 66-70	IWELL(15) 71-75	IWELL(16) 76-80
A																
B																
C			CARD CONTAINS TEST-HOLE NUMBERS TO BE SEARCHED.												
D																
E			MORE THAN ONE TYPE C CARD MAY BE USED FOR ANY												
F																
G			OPTION. MAXIMUM OF 1,000 TEST HOLES MAY BE												
H																
I			SEARCHED.												
J																

FIGURE A-11.—Description of card types A, B, and C.

CARD TYPE D

VARIABLE \ OPTION	COLUMN	IVAR(1) 1-5	IVAR(2) 6-10	IVAR(3) 11-15	IVAR(4) 16-20	IVAR(5) 21-25	IVAR(6) 26-30	IVAR(7) 31-35	IVAR(8) 36-40
A		X							
B									
C			AS MANY AS 8 LAYER VARIABLES MAY						
D			BE TESTED IN OPTION A						
E									
F									
G									
H									
I									
J									

CARD TYPE E

VARIABLE \ OPTION	COLUMN	TVALU(1) 1-12	TVALU(2) 13-24	TVALU(3) 25-36	TVALU(4) 37-48	TVALU(5) 49-60	TVALU(6) 61-72
A		X					
B							
C			AS MANY AS 8 LAYER-VARIABLE VALUES				
D							
E			MAY BE TESTED IN OPTION A. ADDITIONAL				
F							
G			CARD TYPE E IS NEEDED IF MORE THAN 6				
H							
I			VALUES ARE USED.				
J							

CARD TYPE F

VARIABLE \ OPTION	COLUMN	IADVR(1) 1-5	IADVR(2) 6-10	IADVR(3) 11-15	IADVR(4) 16-20	IADVR(5) 21-25	IADVR(6) 26-30	IADVR(7) 31-35	IADVR(8) 36-40
A									
B									
C		X	X	X		AS MANY AS 8 ADDITIONAL LAYER			
D		X	X	X					
E		X	X	X		VARIABLES MAY BE SELECTED.			
F		X	X	X					
G		X	X	X					
H		X	X	X					
I		X	X	X					
J		X	X	X					

FIGURE A–12.—Description of card types D, E, and F.

CARD TYPE G

VARIABLE / OPTION	COLUMN	ISTOR(1) 1-5	ISTOR(2) 6-10	ISTOR(3) 11-15	ISTOR(4) 16-20	ISTOR(5) 21-25	ISTOR(6) 26-30	ISTOR(7) 31-35	ISTOR(8) 36-40	ISTOR(9) 41-45	ISTOR(10) 46-50	ISTOR(11) 51-55	ISTOR(12) 56-60	ISTOR(13) 61-65	ISTOR(14) 66-70	ISTOR(15) 71-75	ISTOR(16) 76-80
A		X	X	X													
B		X	X	X													
C		X	X	X		AS MANY AS 21 TEST-HOLE-RELATED VARIABLES											
D		X	X	X													
E		X	X	X		MAY BE SELECTED IN ANY OPTION. ADDITIONAL											
F		X	X	X													
G		X	X	X		CARD TYPE G IS NEEDED FOR MORE THAN 16											
H		X	X	X													
I		X	X	X		VARIABLES.											
J		X	X	X													

CARD TYPE H

VARIABLE / OPTION	COLUMN	MAJTS(1) 1-5	MAJTS(2) 6-10	MAJTS(3) 11-15	MAJTS(4) 16-20	MAJTS(5) 21-25	MAJTS(6) 26-30	MAJTS(7) 31-35	MAJTS(8) 36-40	MAJTS(9) 41-45	MAJTS(10) 46-50		
A													
B		X	X	X									
C						AS MANY AS 10 TYPES OF MATERIAL MAY							
D													
E						BE SELECTED.							
F													
G													
H													
I													
J													

CARD TYPE I

VARIABLE / OPTION	COLUMN	MACOL(1) 1-5	MACOL(2) 6-10	MACOL(3) 11-15	MACOL(4) 16-20	MACOL(5) 21-25	MACOL(6) 26-30	MACOL(7) 31-35	MACOL(8) 36-40	MACOL(9) 41-45	MACOL(10) 46-50		
A													
B													
C		X	X			AS MANY AS 10 LITHOLOGY COLORS MAY							
D													
E						BE SELECTED							
F													
G													
H													
I													
J													

FIGURE A-13.—Description of card types G, H, and I.

CARD TYPE J

VARIABLE \ OPTION	COLUMN	SUBDA 1-10	SUBTS 11-20	SUBIN 21-30	
A					
B					
C					
D		X	X	X	
E					
F					
G					
H					
I					
J					

CARD TYPE K

VARIABLE \ OPTION	COLUMN	AINC(1) 1-5	AINC(2) 6-10	AINC(3) 11-15	AINC(4) 16-20	AINC(5) 21-25	AINC(6) 26-30	AINC(7) 31-35	AINC(8) 36-40	AINC(9) 41-45	AINC(10) 46-50	AINC(11) 51-55	AINC(12) 56-60	AINC(13) 61-65	AINC(14) 66-70	AINC(15) 71-75	AINC(16) 76-80
A																	
B																	
C																	
D																	
E		X															
F																	
G																	
H																	
I																	
J																	

AS MANY AS 16 INCREMENTS ABOVE BEDROCK MAY BE USED IN OPTION E.

CARD TYPE L

VARIABLE \ OPTION	COLUMN	AKVAL(1) 1-8	AKVAL(2) 9-16	AKVAL(3) 17-24	AKVAL(4) 25-32	AKVAL(5) 33-40	AKVAL(6) 41-48	AKVAL(7) 49-56	AKVAL(8) 57-64	AKVAL(9) 65-72	AKVAL(10) 73-80		
A													
B													
C													
D													
E													
F													
G													
H													
I		X	X	X	X	X							
J													

AS MANY AS 10 DISCRETE VALUES OF PERMEABILITY MAY BE SELECTED

FIGURE A–14.—Description of card types J, K, and L.

CARD TYPE M

VARIABLE OPTION \ COLUMN	SVAL(1) 1-8	SVAL(2) 9-16	SVAL(3) 17-24	SVAL(4) 25-32	SVAL(5) 33-40	SVAL(6) 41-48	SVAL(7) 49-56	SVAL(8) 57-64	SVAL(9) 65-72	SVAL(10) 73-80
A										
B										
C			AS MANY AS 10 STORAGE-COEFFICIENT VALUES							
D										
E			MAY BE SELECTED.							
F										
G										
H										
I	X	X	X	X	X					
J										

CARD TYPE N

VARIABLE OPTION \ COLUMN	IMO 1-5	IDY 6-10	IYR 11-15	ITIM 16-20	JMO 21-25	JDY 26-30	JYR 31-35	JTIM 36-40
A								
B	BEGIN SELECTED				END SELECTED			
C								
D	TIME PERIOD				TIME PERIOD			
E								
F								
G	X	X	X	X	X	X	X	X
H								
I	X	X	X	X	X	X	X	X
J								

FIGURE A-15.—Description of card types M and N.

List of Variables

Variable name	Option	Format	Description of variable

Card Type A

Variable name	Option	Format	Description of variable
NWELL	A-J	I5	Number of test holes to be searched for data retrieval.
LVAR	A	I5	Number of lithologic-layer variables to be retrieved.
NUM	A	I5	Number of selected values of lithologic-layer variables to be retrieved.
LVAR1	C-J	I5	Number of additional lithologic-layer data to be retrieved.
NVAR	A-J	I5	Number of descriptive well data to be retrieved.
ICOND	B	I5	Number of lithologic materials to be retrieved.
ICOL	C	I5	Number of lithologic colors to be retrieved.
IDAT	D	I5	If a 1 is punched in column 40, data are retrieved from subdatum planes (see card type J). If column 40 is blank, this option is bypassed.

Variable name	Option	Format	Description of variable
			Card Type A—Continued
INC	E	I5	An integer punched in columns 41–45 is the number of increments to be searched above bedrock (see card type K). If columns 41–45 are blank, this option is bypassed.
ILOG	F	I5	A 1 in column 50 indicates a total test-hole-log retrieval. If column 50 is blank, only the selected layer variable is retrieved.
ILVL	G	I5	A 1 in column 55 calls water level for defining saturated zone (see card type N). If column 55 is blank, this option is bypassed.
IGSUB	H	I5	An integer in columns 56–60 indicates the number of feet below ground surface to be searched by increments. If columns 56–60 are blank, this option is bypassed.
KTESK	I	I5	An integer in columns 61–65 indicates the number of permeability values assigned (see card type L). If columns 61–65 are blank, this option is bypassed.
KTESS	I	I5	An integer in columns 66–70 indicates the number of storage-coefficient values assigned (see card type M). If columns 66–70 are blank, this option is bypassed.
KSAT	I	I5	If column 75 is a 1, K and S values are averaged for the total well log. If column 75 is blank, K and S values are averaged only for the saturated zone.
			Card Type B
IPUNH(1)	D,E,G	I5	A 1 in column 5 causes retrieved layer data to be punched on cards.
IPUNH(2)	J	I5	A 1 in column 10 causes the net thickness of selected lithologic layers to be punched on cards.
IPUNH(3)	B–J	I5	A 1 in column 15 causes test-hole (well) variables to be punched on cards.
IPUNH(4)	C,F	I5	A 1 in column 20 causes lithologic color to be punched on cards.
IPUNH(5)	B	I5	A 1 in column 25 causes lithologic material type to be punched on cards.
IPUNH(6)	I	I5	A 1 in column 30 causes the weighted average of hydraulic coefficients to be punched on cards.

Note: A blank in appropriate columns will bypass punch output for that option.

			Card Type C
IWELL(n)	A–J	16I5	This array is used to select test-hole data by numbers. As many as 1,000 drill-hole numbers may be retrieved from this array selectively.

Note: n indicates array size.

			Card Type D
IVAR(n)	A	8I5	Data are retrieved from this array for as many as 8 lithologic-layer variables. These variables describe hydraulic and geologic characteristics for discrete layers.

Variable name	Option	Format	Description of variable
		Card Type E	
TVALU(n)	A	6F12.4	Data are retrieved from this array for as many as 8 test values (6 per card). One or more values may be tested for each variable indicated on card type D. Additional card type E is needed for more than 6 values.
		Card Type F	
IADVR(n)	C–J	8I5	Data are retrieved from this array for as many as 8 layer-variable values in addition to the ones tested for using card types D and E.
		Card Type G	
ISTOR(n)	A–J	16I5	Data are retrieved from this array for as many as 21 drill-hole variables. An additional card, type G, is needed for more than 16 test-hole variables.
		Card Type H	
MAJTS(n)	B	10I5	Data are retrieved from this array for as many as 10 discrete types of material based upon size-distribution analyses.
		Card Type I	
MACOL(n)	C	10I5	Data are retrieved from this array for as many as 10 discrete colors of material.
		Card Type J	
SUBDA	D	F10.0	Maximum elevation to be searched (feet above mean sea level) when selecting data from horizontal subdatum planes.
SUBTS	D	F10.0	Minimum elevation to be searched (feet above mean sea level) when selecting data from horizontal subdatum planes.
SUBIN	D	F10.0	The distance in feet to be stepped down for subsequent subdatum planes from SUBDA to SUBTS.
		Card Type K	
AINC(n)	E	16I5	Data are retrieved from this array for as many as 16 increments (feet above bedrock) for which data are retrieved.
		Card Type L	
AKVAL(n)	I	10F8.0	Data are retrieved from this array for as many as 10 discrete permeability values.
		Card Type M	
SVAL(n)	I	10F8.0	Data are retrieved from this array for as many as 10 discrete storage-coefficient values.

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Variable name	Option	Format	Description of variable
			Card Type N
IMO	G,I	I5	Month of beginning of time period for which ground-water levels are averaged when data are retrieved from the saturated zone.
IDY	G,I	I5	Day of beginning of time period.
IYR	G,I	I5	Year of beginning of time period.
ITIM	G,I	I5	Time (military) of beginning of time period.
JMO	G,I	I5	Month of ending of time period.
JDY	G,I	I5	Day of ending of time period.
JYR	G,I	I5	Year of ending of time period.
JTIM	G,I	I5.	Time (military) of ending of time period.

APPENDIX B.—FORMATS USED FOR DATA STORAGE

INPUT-CARD FORMAT USED TO STORE DRILL-HOLE DATA

I2	I5	I5	I5	I5	F 11.3	F 11.3	F 11.3	F 11.3	
VARIABLE NO. (1-21)	DRILL-HOLE NO	DRILL-HOLE NO	DRILL-HOLE NO	DRILL-HOLE NO.	VARIABLE VALUE	VARIABLE VALUE	VARIABLE VALUE	VARIABLE VALUE	COLUMN 67-80 BLANK

INPUT-CARD FORMAT USED TO STORE LAYER DATA

I4	F4.0	F4.0	IX, F5.0	F3.0	F3.0	F 7.0	F 7.0	F 10.0	I4	
DRILL-HOLE NUMBER (STORED WITH DRILL-HOLE DATA)	LAYER NUMBER (1)	LAYER THICKNESS (2)	TYPE OF MATERIAL (3)	COLOR OF MATERIAL (4)	METHOD OF ANALYSIS (5)	TRANSMISSIBILITY (T) (6)	PERMEABILITY (K) (7)	STORAGE COEFFICIENT (S) (8)	NUMBER OF LAYERS (STORE WITH DRILL-HOLE DATA)	COLUMNS 53-80 BLANK

INPUT-CARD FORMAT USED TO STORE WATER-LEVEL DATA

I4	I2	I7	I5	F 7.2	I7	I5	F7.2	I7	I5	F 7.2	
WELL NO. *	CODE NO. **	DATE MONTH, DAY, YEAR 2 DIGITS EACH	MILITARY TIME	DEPTH TO WATER *** FEET BELOW TOP OF PIPE	DATE	TIME	DEPTH	DATE	TIME	DEPTH	COLUMN 64-80 BLANK

* ALL I FORMAT INPUT DATA IS RIGHT JUSTIFIED
** CODE 1 = RECORDER-CHART DATA — CODE 2 = TAPE-DOWN DATA
*** NO ZERO PUNCHES NEEDED IN BLANKS ON CARDS

FIGURE B-1.—Input card formats.

APPENDIX C.–SOURCE LISTING FOR STORAGE AND RETRIEVAL PROGRAMS

CARD

```
  1    C                                    APPENDIX C
  2    C
  3    C
  4    C                    RETRIEVAL PROGRAM FOR HYDROGEOLOGIC DATA
  5    C        SUBROUTINES USED NAMED (CODE, KTESX, COLOR, SERCH, MATRL, TAPES, JULDY,
  6    C        WATLV)
  7            DEFINE FILE 1(1000,161,U,ISEC),2(21,1000,U,ISEC1),3(10,320,U,IM)
  8            DIMENSION V(21),VV(21),VAR(8)
  9            DIMENSION MAJTS(10),MACOL(10),WATEL(1000),AINC(20),IPUNH(6)
 10            COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
 11            COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
 12            COMMON ISEC,ISEC1,ISEC2,AKVAL(10),SVAL(10),KTEST,KSAT,LTEST
 13    C     HEADERS READ IN FOR LABELING VARIABLES.
 14    C     CONTROLS FOR SELECTING WELL VARIABLES.
 15    C     FORMAT(16I5)
 16    C
 17    C     NWELL—NUMBER OF WELLS TO BE SEARCHED.
 18    C     LVAR —NUMBER OF LAYER VARIABLES TO BE TESTED.
 19    C     LVAR1—NUMBER OF LAYER TEST VALUES, TVALU (I), TO BE READ IN.
 20    C     VALUES OF (TVALU (I) FORMAT (6F12.4/2F12.4))
 21    C     NUM  —NUMBER OF ADDITIONAL LAYER VARIABLES NOT USED FOR SEARCHING.
 22    C     NVAR —NUMBER OF WELL VARIABLES
 23    C     ICOND—'0'—BYPASS
 24    C            '1'—CALLS IN SUBROUTINE FOR TESTING TYPE OF MATERIAL IN THE LAYERS.
 25    C     ICOL— '0'—BY-PASS
 26    C            '1'—CALLS IN SUBROUTINE FOR TESTING LAYER COLORS.
 27    C     IDAT— '0'—BY-PASS
 28    C            '1'—READS IN SUBSTRATUM ELEVATION TO BE TESTED. (SUBDA)
 29    C     INC — '0'—BY PASS
 30    C            'N'—READS IN NUMBER OF INCREMENTS IN FEET ABOVE BEDROCK TO BE
 31    C                SEARCHED.
 32    C     ILOG— '0'—WRITES OUT LAYER VARIABLE SEARCHED
 33    C            '1'—WRITES OUT ALL LAYERS IN A WELL
 34  99997 CONTINUE
 35    C     ILVL— '0' BY PASS
 36    C            '1' WATER LEVEL CALLED FOR SEARCHING IN SATURATED ZONE
 37    C     IGSUB—'0' BY PASS
 38    C            '1' STEPS DOWN INCREMENTALLY BELOW GROUND SURFACE
 39    C     KTESK—'0' BY PASS
 40    C            'N' NUMBER OF PERMEABILITY VALUES TO BE USED
 41    C     KTESS—'0' BY PASS
 42    C            'N' NUMBER OF STORAGE COEFFICIENT VALUES TO BE USED
 43    C     KSAT— '0' BY PASS
 44    C          , '1' K AND S VALUES ARE AVERAGED FOR TOTAL THICKNESS
 45    C     PUNCH A '1' IN ILVL AND A '0' IN KSAT TO AVERAGE K AND S VALUES IN THE
 46    C     SATURATED ZONE
 47    C     FORMAT FOR VARIABLES NWELL THROUGH KSAT IS 15I5.
 48  99998 CONTINUE
 49    C     IPUNH (N) — '0' NO PUNCH  '1' PUNCH
 50    C     THE FOLLOWING PUNCH COMMANDS ARE IN SIX SEPARATE FIVE COLUMN FIELDS.
 51    C     THE NUMBER FOLLOWING EACH COMMAND IS THE FIELD NUMBER.
 52    C                     LAYER DATA (1)
 53    C                     NET THICKNESS (2)
 54    C                     WELL VARIABLES (3)
 55    C                     COLOR OF LITHOLOGY (4)
 56    C                     MATERIAL TYPE OF LITHOLOGY (5)
 57    C                     WGT. AVE. PERM. AND WGT. AVE. STOR. COEFF. (6)
 58    C     VALUES OF SUBDA, SUBTS, SUBIN (FORMAT (3F10.0))
 59    C     SUBDA—SUBSTRATUM ELEVATION
 60    C     SUBTS—MINIMUM ELEVATION TO BE SEARCHED
 61    C     SUBIN—INCREMENT IN FEET TO BE SUBTRACTED FROM SUBDATUM
 62    C     SUBROUTINE TAPES LOADS TEST HOLE AND LAYER DATA FROM TAPES TO DISC FILE
 63    C     FOR SEARCHING.
 64          CALL TAPES
```

```
65           DO 1000 J=1,2
66    C      READ LAYER VARIABLE NAMES FROM CONTROL CARDS
67    1000 READ(5,106)(HEAD(J,I),I=1,108)
68     106 FORMAT(72A1,/,36A1)
69           IM=1
70    C      WRITES LAYER VARIABLE NAMES ON DISC
71           WRITE(3'IM)HEAD
72           DO 999 J=1,2
73    C      READ TEST HOLE VARIABLE NAMES FROM CONTROL CARDS
74     999 READ(5,107)(HEAD(J,I),I=1,252)
75     107 FORMAT(72A1/72A1/72A1/36A1)
76           IM=3
77    C      WRITES TEST HOLE VARIABLE NAMES ON DISC
78           WRITE(3'IM)HEAD
79    1012 READ(5,   100)NWELL,LVAR,LVAR1,NUM,NVAR,ICOND,ICOL,IDAT,INC,ILOG,IL
80          1VL,IGSUB,KTESK,KTESS,KSAT
81    C      TEST ON NUMBER OF TEST HOLES TO BE SEARCHED
82           IF(NWELL)1013,1013,4000
83    C      READ TEST HOLE NUMBERS TO BE SEARCHED (16I5) INTO ARRAY
84    4000 READ(5,100)(IPUNH(I),I=1,6)
85           READ(5,100)(IWELL(I),I=1,NWELL)
86     100 FORMAT(16I5)
87    C      TEST ON NUMBER OF LAYER VARIABLES TO BE TESTED
88    4001 IF(LVAR)4003,4003,4002
89    C      READ VARIABLES TO BE TESTED INTO ARRAY
90    4002 READ(5,100)(IVAR(I),I=1,LVAR)
91    C      TEST ON NUMBER OF TEST VALUES TO BE TESTED FOR
92    4003 IF(LVAR1)4005,4005,4004
93    C      READ VALUE OF LAYER VARIABLE TO BE TESTED INTO ARRAY
94    4004 READ(5,101)(TVALU(I),I=1,LVAR1)
95     101 FORMAT(6F12.4,/,2F12.4)
96    C      TEST ON NUMBER OF ADDITIONAL LAYER VARIABLES NEEDED(1-7)
97    4005 IF(NUM)4007,4007,4006
98    C      READ ADDITIONAL LAYER VARIABLES INTO ARRAY
99    4006 READ(5,100)(IADVR(I),I=1,NUM)
100   C      TEST ON NUMBER OF ADDITIONAL TEST HOLE VARIABLES (1-21)
101   4007 IF(NVAR)4009,4009,4008
102   C      READ ADDITIONAL TEST HOLE VARIABLES INTO ARRAY
103   4008 READ(5,100)(ISTOR(I),I=1,NVAR)
104   C      TEST IF SUBDATUM ELEVATION IS TO BE SEARCHED
105   4009 IF(IDAT)3021,3021,3023
106   C      TEST IF A HEIGHT ABOVE BEDROCK IS TO BE SEARCHED
107   3021 IF(INC)3022,3022,3024
108   3024 READ(5,1112)(AINC(I),I=1,INC)
109   1112 FORMAT(16F5.1)
110         GO TO 3124
111   3022 SUBDA=0.0
112         GO TO 3124
113   C      READ FROM ONE CARD,(1)ELEV TO BE SEARCHED,(2)ELEV TO STOP ON,(3)
114   C      INCREMENT TO STEP DOWN-FEET
115   3023 READ(5,500)SUBDA,SUBTS,SUBIN
116    500 FORMAT(3F10.0)
117   C      TEST IF MAJOR OR MINOR LITHOLOGIC TYPE WANTED
118   3124 IF(ICOND)5002,5002,5001
119   C      READ CODE OF LITHOLOGY WANTED INTO ARRAY
120   5001 READ(5,100)(MAJTS(I),I=1,ICOND)
121   C      TEST IF MAJOR OR MINOR COLOR OF LITHOLOGY WANTED
122   5002 IF(ICOL)5004,5004,5003
123   5003 READ(5,100)(MACOL(I),I=1,ICOL)
124   5004 LIST=NUM+LVAR
125         KTEST=KTESK+KTESS
126         IF(KTESK)1122,1122,1120
127   1120 READ(5,1121)(AKVAL(I),I=1,KTESK)
128   1121 FORMAT(10F8.0)
129   1122 IF(KTESS)1124,1124,1123
130   1123 READ(5,1121)(SVAL(I),I=1,KTESS)
131   1124 CALL CODE(NWELL,LVAR,LVAR1,NUM,NVAR,ICOND,ICOL,IDAT,INC,ILOG,IPUNH
132         1,ILVL,MAJTS,MACOL,LIST,SUBDA,SUBTS,SUBIN,ISTOR,IADVR,KSAT,IGSUB,KT
133         2ESK,KTESS,AKVAL,SVAL,AINC)
134         IF(ICOND)5006,5006,5005
135   5005 CALL MATRL(ICOND,NWELL,MAJTS,IPUNH(5))
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136     5006 IF(ICOL)5080,5080,5007
137     5007 CALL COLOR(ICOL,NWELL,MACOL,IPUNH(4))
138     5080 IF(IGSUB)2,2,1
139        1 SUBDA=1.0
140          AMIN=9999.
141          GO TO 8002
142        2 IF(SUBDA)8000,8000,8002
143     8000 IF(ILVL)8002,8002,8001
144     8001 CALL WATLV(NWELL,IWELL,WATEL)
145     8002 IF(LIST)6004,6004,3014
146     3014 IM=1
147   C      READS HEADERS OF LAYER VARIABLES FROM DISC
148          READ(3'IM)HEAD
149          DO 1003 K=1,2
150          J=0
151   C      TEST FOR NUMBER OF VARIABLES TO BE SELECTED
152          IF(LVAR)903,903,902
153      902 DO 1002 JC=1,LVAR
154   C      SELECTS HEADERS FOR VARIABLES
155          ISTRT=(IVAR(JC)*12-11)
156          IEND=ISTRT+11
157          DO 1001 L=ISTRT,IEND
158          J=J+1
159     1001 TITLE(K,J)=HEAD(K,L)
160     1002 CONTINUE
161   C      TEST FOR ADDITIONAL LAYER VARIABLES
162          IF(NUM)1003,1003,903
163      903 DO 2002 JC=1,NUM
164   C      SELECTS HEADERS FOR LAYER VARIABLES
165          ISTRT=(IADVR(JC)*12-11)
166          IEND=ISTRT+11
167          DO 2001 L=ISTRT,IEND
168          J=J+1
169     2001 TITLE(K,J)=HEAD(K,L)
170     2002 CONTINUE
171     1003 CONTINUE
172   C      TEST ON SUBDATUM ELEV
173          IF(SUBDA)5016,5016,3012
174     5016 IF(ILVL)3013,3013,5017
175   C      LABELS TEST HOLE NO., SUBDATUM, DEPTH TO TOP OF LAYER, ELEVATION OF THE
176   C      TOP OF A LAYER, AND ELEVATION OF THE TOP OF SATURATED ZONE.
177     5017 WRITE(6,109)
178          WRITE(6,5018)
179     5018 FORMAT('+',' WN SUB   LD L ELEV SATURATED ZONE')
180          GO TO 3013
181     3012 WRITE(6,109)
182   C      LABELS TEST HOLE NO., SUBDATUM, DEPTH TO TOP OF LAYER, ELEV OF TOP OF
183   C      LAYER IN WHICH SUBDATUM IS FOUND
184      109 FORMAT('0')
185          WRITE(6,108)
186      108 FORMAT('+',' WN SUB   LD L ELEV')
187     3013 IEND=J
188          DO 1004 K=1,2
189   C      WRITES HEADERS FOR VARIABLES
190     1004 WRITE(6,115)(TITLE(K,J),J=1,IEND)
191      115 FORMAT (' ',22X, 96A1)
192          ELV1=0.0
193          ICONT=0
194          JCONT=0
195   C      SET BRANCH =1
196   C      READ A TEST HOLE NUMBER TO BE SEARCHED
197     7001 SUB=SUBDA
198          ICONT=ICONT+1
199          IF(INC)1110,1110,1113
200     1110 IINC=1
201          GO TO 1114
202     1113 IINC=INC
203     1114 DO 1111 II=1,IINC
204          DO 10 IC=1,NWELL
205          LTEST=0
206          IBRN=1
```

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207            ISEC=21
208            JBRN=2
209            SUBDA=SUB
210            IF(SUBDA)5000,5000,3001
211      5000  IF(ILVL)3001,3001,502
212       502  JBRN=1
213    C        READS TOTAL NUMBER OF LAYERS FOR EACH TEST HOLE FROM DISC
214      3001  READ (2'ISEC)WVAR
215            IKK=IWELL(IC)
216    C        BRANCHES TO DIFFERENT PARTS OF PROGRAM
217            GO TO(3002,3003,53),IBRN
218    C        SETS MAXLA EQUAL TO TOTAL NO. OF LAYERS FOR EACH TEST HOLE
219      3002  MAXLA=WVAR(IKK)
220            GO TO 3004
221    C        READS GROUND SURFACE ELEV FOR EACH TEST HOLE FROM DISC
222      3003  GSELV=WVAR(IKK)
223            GSURF=GSELV
224    C        SETS SECTOR TO FIND BEDROCK ELEV
225            ISEC=7
226    C        SET BRANCH = 3
227            IBRN=3
228            GO TO 3001
229    C        READS BEDROCK ELEV FOR EACH TEST HOLE FROM DISC
230        53  BEDRK=WVAR(IKK)
231    C        TEST IF SUBDATUM ABOVE BEDROCK IS DESIRED
232            IF(INC)3006,3006,9001
233    C        ESTABLISH SUBDATUM ELEV ABOVE BEDROCK
234      9001  SUBDA=BEDRK+AINC(II)
235            GO TO 3006
236    C        TEST IF SUBDATUM ABOVE BEDROCK EXISTS
237      3004  IF(SUBDA)9999,9999,3005
238      9999  IF(ILVL)9002,9002,3005
239    C        TEST IF SUBDATUM ABOVE BEDROCK IS DESIRED
240      9002  IF(INC)3006,3006,3005
241    C        SETS SECTOR TO SELECT GROUND SURFACE ELEV.
242      3005  ISEC=6
243    C        SET BRANCH = 2
244            IBRN=2
245            GO TO 3001
246      3006  IF(IGSUB)12001,12001,2000
247      2000  SUBDA=GSURF
248            SUBDA=SUBDA-(IGSUB*ICONT)
249            SUBTS=BEDRK
250            IF(SUBTS)2003,2003,2005
251      2003  WRITE(6,2004)IWELL(IC)
252      2004  FORMAT('0',25('*'),'NO BEDROCK ELEVATION FOR WELL ',I4,25('*'),//)
253            GO TO 10
254      2005  IF(BEDRK-AMIN)2006,12001,12001
255      2006  AMIN=BEDRK
256     12001  ISEC2=IWELL(IC)
257            ILAY=1
258            READ (1'ISEC2)STRAT
259            SUM=0.0
260            THIK=0.0
261      7005  IWLL=IWELL(IC)
262    C        TEST IF TEST HOLE HAS A LOG
263      7006  IF(MAXLA)10,10,200
264    C        TEST HOLES WITH MORE THAN TWENTY LAYERS ARE WRITTEN ON PRINTER.
265       200  IF(MAXLA-20)203,203,202
266       202  WRITE(6,104)IWELL(IC)
267       104  FORMAT(' ','LAYER NUMBER GREATER THAN 20 ON TEST HOLE ',I4)
268            GO TO 10
269    C        READS THROUGH TEST HOLE LAYERS
270       203  IF(ILVL)9997,9997,5009
271      5009  SUBDA=WATEL(IKK)
272      9997  DO 90 JLAY=1,MAXLA
273    C        SUMS LAYER THICKNESS
274            SUM=SUM + STRAT(ILAY,2)
275    C        TEST IF SUBDATUM ELEV IS READ
276         5  CONTINUE
277      5008  IF(SUBDA)3008,3008,3007
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278    3007 IF(SUBDA-GSELV)4016,4016,10
279    4016 IF(SUBDA-BEDRK)10,4017,4017
280  C       SUBTRACT LAYER THICKNESS OFF GROUND SURFACE
281    4017 ELEV=GSELV-STRAT(ILAY,2)
282  C       TEST NEW GROUND SURF AGAINST SUBDATUM ELEV
283          IF (ELEV-SUBDA)3010,3010,3009
284  C       RESFTS GROUND SURFACE TO TOP OF NEXT LAYER
285    3009 GSELV=ELEV
286  C       INCREASE LAYER NO. BY 1
287          ILAY=ILAY+1
288          GO TO 90
289  C       COMPUTES DEPTH TO TOP OF LAYER CONTAINING SUBDATUM
290    3010 GO TO (5010,5012),JBRN
291    5010 JBRN=2
292          SUM=GSURF-SUBDA
293          STRAT(ILAY,2)=SUBDA-ELEV
294          ELEV=SUBDA
295          GSELV=SUBDA
296          SUM=SUM+STRAT(ILAY,2)
297          IF(KSAT)3007,3007,7008
298    7008 CALL KTESX(ILAY,S7,S8,AKV1,SV1)
299    5012 DTOLA=GSURF-GSELV
300  C       TEST IF ADDITIONAL LAYER VARIABLES
301    3020 IF(NUM)3016,3016,3017
302    3017 DO 3015 IJJ=1,NUM
303  C       SETS K TO ADDITIONAL LAYER VARIABLE
304          K=IADVR(IJJ)
305  C       SETS IV TO THE NUMBER OF THE ADDITIONAL LAYER VARIABLES PLUS THE NUMBER OF
306  C       LAYER VARIABLES TO BE SELECTED
307          IV=IJJ+LVAR
308  C       STORES ADDITIONAL LAYER VARIABLES IN ARRAY
309    3015 VAR(IV)=STRAT(ILAY,K)
310          IF(LVAR)3016,3025,3016
311    3016 DO 3011 IJ=1,LVAR
312  C       SETS K TO LAYER VARIABLE TO BE SELECTED
313          K=IVAR(IJ)
314  C       STORES LAYER VARIABLES SELECTED IN ARRAY
315    3011 VAR(IJ)=STRAT(ILAY,K)
316  C       COMPUTES DEPTH TO TOP OF LAYER WHICH CONTAINS SUBDATUM
317    3025 ELV=GSURF-(SUM-STRAT(ILAY,2))
318  C       SETS IDT TO DEPTH TO LAYER
319          IDT=DTOLA
320  C       SETS ISUB TO SUBDATUM ELEVATION
321          ISUB=SUBDA
322          IF(KSAT)300,300,7003
323  C       TEST IF LOG OF ALL LAYERS IS WANTED
324     300 IF(ILOG)7050,7050,7003
325  C       WRITE DATA OUT FOR ALL LAYERS
326    7050 IF(IGSUB)7051,7051,7003
327  C       LABELS SUBDATUM ELEVATION, DEPTH TO LAYER, ELEVATION OF TOP OF LAYER
328  C       CONTAINING SUBDATUM, AND SELECTED VARIABLES.
329    7051 IF(ELV-ELV1)7003,10,7003
330    7003 WRITE (6,113) IWLL,     ISUB,IDT,ELV,(VAR(I),I=1,LIST)
331     113 FORMAT(' ',I3,I5,I4,F8.2,8F12.4)
332  C       TEST FOR PUNCHED OUTPUT.
333          IF(IPUNH(1))94,94,1050
334    1050 WRITE(7,1051)IWLL,ISUB,IDT,ELV,(VAR(I),I=1,LIST)
335    1051 FORMAT(I3,I5,I4,F8.2,5F12.4,/,5F12.4)
336      94 IF(KSAT)301,301,93
337     301 IF(ILVL)10,10,95
338      95 ILAY=ILAY+1
339  C       TEST LAYER VARIABLE VALUES SEARCHED.
340  C       LVAR1 IS THE NUMBER OF VALUES SELECTED FOR EACH LAYER VARIABLE TESTED.
341    3008 IF(LVAR1)4018,4018,904
342     904 DO 6 JJ=1,LVAR
343          K=IVAR(JJ)
344          DO 6 J=1,LVAR1
345  C       TEST DATA IN LAYER AGAINST TEST VALUE
346          IF(TVALU(J)-STRAT(JLAY,K))6,4011,6
347       6 CONTINUE
348          GO TO 9
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349   C        TEST FOR ADDITIONAL LAYER VARIABLES
350    4011 THIK=THIK+STRAT(JLAY,2)
351    4018 IF(NUM)6003,6003,4010
352    4010 DO 8 IJ=1,NUM
353         K=IADVR(IJ)
354   C        SUMS NUMBER OF LAYER VARIABLES TESTED AND ADDITIONAL LAYER VARIABLES
355         IV=IJ+LVAR
356       8 VAR(IV)=STRAT(JLAY,K)
357   C        TEST ON NUMBER OF LAYER VARIABLES TO BE SEARCHED
358    6003 IF(LVAR)6001,6001,6000
359    6000 DO 7 IJ=1,LVAR
360   C        SETS K TO THE VARIABLE TESTED
361         K=IVAR(IJ)
362   C        SETS VAR(IJ) TO THE VALUE STORED IN LAYER DATA
363       7 VAR(IJ)=STRAT(JLAY,K)
364   C        TEST ON VARIABLES TO BE SEARCHED FOR OR ADDITIONAL LAYER VARIABLES
365    6001 IF(LIST)6004,6004,6002
366    6002 IF(ILVL)6020,6020,9
367    6020 WRITE(6,103)IWLL,JLAY,(VAR(I),I=1,LIST)
368     103 FORMAT(' ',10X,2I5,8F12.4)
369   C        TEST FOR PUNCHED OUTPUT
370         IF(IPUNH(1))9,9,6006
371    6006 WRITE(7,6007)IWLL,JLAY,(VAR(IJ),IJ=1,LIST)
372    6007 FORMAT(2I4,8F9.2/,8X,8F9.2/,8X,5F9.2)
373   C        RETURN TO READ NEXT LAYER
374       9 IF(KTEST)90,90,6008
375    6008 IF(ILVL)92,92,91
376      91 KLAY=ILAY-1
377         GO TO 920
378      92 KLAY=JLAY
379   C        SUBROUTINE KTESX COMPUTES AVERAGE PERMEABILITY AND STORAGE COEFFICIENT
380   C        VALUES.
381     920 CALL KTESX(KLAY,S7,S8,AKV1,SV1)
382      90 CONTINUE
383      93 IF(KTEST)6011,6011,6009
384    6009 AKV1=AKV1/S7
385         SV1=SV1/S8
386         WRITE(6,6010)IWLL,AKV1,SV1
387    6010 FORMAT(' ','HOLE NUMBER= ',I4,/,' WGT. AVE.PERM.= ',F10.0,/,' WGT.
388        1AVE. STORAGE COEFFICIENT= ',F10.3)
389         IF(IPUNH(6))6011,6011,11100
390   11100 WRITE(7,11101)IWLL,AKV1,SV1
391   11101 FORMAT(I4,F5.0,F5.3)
392   C        RETURN TO READ NEXT TEST HOLE
393    6011 IF(LVAR1)10,10,4019
394    4019 WRITE(6,161)IWLL,THIK,(TVALU(J),J=1,LVAR1)
395     161 FORMAT(' ',' HOLE NO. ',I5,' NET THICK ',F12.0,' CODES ',5X,6F4.0)
396         IF(IPUNH(2))10,10,4020
397   C        PUNCHES DATA ON CARDS
398    4020 WRITE(7,161)IWLL,THIK,(TVALU(J),J=1,LVAR1)
399      10 CONTINUE
400    1111 CONTINUE
401   C        TEST IF SUBDATUM ELEVATION IS SELECTED              .
402    6005 IF(ILVL)99,99,98
403      98 SUBDA=0.0
404      99 IF(SUBDA)6004,6004,7000
405   C        TEST IF POINT ABOVE BEDROCK IS SELECTED
406    7000 IF(INC)9003,9003,6004
407   C        STEP DOWN SUBDATUM TO BE SEARCHED
408    9003 IF(IGSUB)9004,9004,9005
409    9004 SUBDA=SUBDA-SUBIN
410         IF(SUBDA-SUBTS)6004,6004,7002
411    7002 ELV1=ELV
412         GO TO 7001
413   C        TEST IF SUBDATUM WANTED IS BELOW LOWER LIMIT
414    9005 IF(SUBDA-AMIN)6004,6004,7001
415   C        RESET ELEVATION OF TOP OF LAYER
416   C        TEST IF ADDITIONAL TEST HOLE VARIABLES ARE SELECTED
417    6004 IF(NVAR)1011,1011,11
418   C        SET DISC SECTOR
419      11 IM=3
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420    C       READ HEADERS FOR ADDITIONAL TEST HOLE VARIABLES
421            READ (3'IM) HEAD
422            JSTRT=1
423            JEND=9
424            DO 1009 IL=1,3
425    C       TEST IF NUMBER IS MORE THAN NINE
426            IF (NVAR-JEND)1010,1010,12
427    C       SETS NUMBER OF VARIABLES TO BE WRITTEN
428      1010 JEND=NVAR
429        12 DO 1007 K=1,2
430            J=0
431    C       READS NINE HEADERS FROM DISC STORAGE
432            DO 1006 JC=JSTRT,JEND
433            ISTRT=(ISTOR(JC)*12-11)
434            IEND=ISTRT+11
435            DO 1005 L=ISTRT,IEND
436            J=J+1
437      1005 TITLE(K,J)=HEAD(K,L)
438      1006 CONTINUE
439      1007 CONTINUE
440            IEND=J
441            DO 1008 K=1,2
442    C       WRITES NINE HEADERS ON EACH PRINTER LINE
443      1008 WRITE (6,105) (TITLE (K,J),J=1,IEND)
444       105 FORMAT(' ',108A1)
445    C       TEST IF SUBDATUM ELEVATION IS SELECTED
446            DO 22 J=1,NWELL
447            DO 20 I=JSTRT,JEND
448    C       STORES SELECTED VARIABLES ON DISC
449            ISEC1=ISTOR(I)
450    C       READS VARIABLES FROM DISC
451            READ (2'ISEC1)WVAR
452    C       SETS IK TO TEST HOLE NUMBER
453            IK=IWELL(J)
454    C       SETS IKK TO VARIABLE
455            IKK=ISTOR(I)
456            V(IKK)=WVAR(IK)
457        20 CONTINUE
458            DO 21 I=JSTRT,JEND
459            K=ISTOR(I)
460        21 VV(I)=V(K)
461    C       WRITES VARIABLES FOUND AT SUBDATUM ON PRINTER
462            WRITE (6,5400) (VV(I),I=JSTRT,JEND)
463      5400 FORMAT(' ',9F12.3)
464    C       TEST FOR PUNCHED OUTPUT
465            IF(IPUNH(3))22,22,1054
466      1054 WRITE(7,1055)(VV(I),I=JSTRT,JEND)
467      1055 FORMAT(6F12.3,/,6F12.3,/,6F12.3,/,3F12.3)
468    C       PUNCHES VARIABLES FOUND AT SUBDATUM, SIX PER CARD
469        22 CONTINUE
470    C       TEST IF ALL VARIABLES SELECTED HAVE BEEN WRITTEN
471            IF (JEND-NVAR)23,1011,1011
472    C       RESET TO NEXT NINE HEADINGS AND VARIABLES
473        23 JSTRT=JEND+1
474            JEND=JEND+9
475      1009 CONTINUE
476      1011 CONTINUE
477            GO TO 1012
478      1013 STOP
479            END
480    C
481    C
482    C       SUBROUTINE CODE DISPLAYS A LIST OF OPTIONS SELECTED BY THE USER.
483    C       RETRIEVAL CONTROL CARD CODING IS DISPLAYED ON PRINTER FOR EACH JOB SETUP.
484            SUBROUTINE CODE(NWELL,LVAR,LVAR1,NUM,NVAR,ICOND,ICOL,IDAT,INC,ILOG
485           1,IPUNH,ILVL,MAJTS,MACOL,ILIST,SUBDA,SUBTS,SUBIN,ISTOR,IADVR,KSAT,I
486           2GSUB,KTESK,KTESS,AKVAL,SVAL,AINC)
487            DIMENSION AKVAL(10),SVAL(10),AINC(20)
488            DIMENSION MAJTS(10),MACOL(10),ISTOR(21),IADVR(8),IPUNH(6)
489            COMMON IWELL(1000),IVAR(8),TVALU(8)
490            WRITE(6,120)
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491   120 FORMAT('1','  IF TEST CODES ARE EQUAL TO 1, THEN TEST IS USED, IF E
492      1QUAL TO 0, THEN TEST IS BY-PASSED',//)
493        WRITE(6,100) NWELL
494   100 FORMAT(' ','NUMBER OF TEST HOLES TO BE SEARCHED= ',I3)
495        WRITE(6,133)(IWELL(I),I=1,NWELL)
496   133 FORMAT(' ','TEST HOLES THAT ARE BEING TESTED ARE',/,41(24I5,/))
497        WRITE(6,101)LVAR
498   101 FORMAT('0','NUMBER OF LAYER VARIABLES TO BE TESTED= ',I2)
499        IF (LVAR)2,2,1
500      1 WRITE(6,102)(IVAR(I),I=1,LVAR)
501   102 FORMAT(' ','THE VARIABLES THAT ARE TO BE TESTED ARE',/,8I5)
502      2 WRITE(6,103)LVAR1
503   103 FORMAT('0','NUMBER OF TEST VALUES= ',I2)
504        IF(LVAR1)4,4,3
505      3 WRITE(6,104)(TVALU(I),I=1,LVAR1)
506   104 FORMAT(' ','TEST VALUES OF EACH LAYER ARE',/,8F10.4)
507      4 WRITE(6,105)NUM
508   105 FORMAT('0','NUMBER OF ADDITIONAL LAYER VARIABLES= ',I2)
509        IF(NUM)6,6,5
510      5 WRITE(6,106)(IADVR(I),I=1,NUM)
511   106 FORMAT(' ','ADDITIONAL LAYER VARIABLES ARE',/,8I5)
512      6 WRITE(6,116)ILIST
513   116 FORMAT('0','TOTAL NUMBER OF LAYER VARIABLES THAT ARE CALLED= ',I2)
514        WRITE(6,107)NVAR
515   107 FORMAT('0','NUMBER OF TEST HOLE VARIABLES= ',I2)
516        IF(NVAR)8,8,7
517      7 WRITE(6,108)(ISTOR(I),I=1,NVAR)
518   108 FORMAT(' ','THE TEST HOLE VARIABLES ARE',/,21I5)
519      8 WRITE(6,109)IDAT
520   109 FORMAT('0','SUBDATUM ELEVATION CODE= ',I2)
521        IF(IDAT)10,10,9
522      9 WRITE(6,110)SUBDA,SUBTS,SUBIN
523   110 FORMAT(' ','ELEVATION TO BE SEARCHED= ',F10.0,/,' ELEVATION TO TER
524      1MINATE SEARCHING= ',F10.0,/,' STEP-DOWN INCREMENT= ',F10.0)
525     10 IF(INC)132,132,130
526   130 WRITE(6,131)INC,(AINC(I),I=1,INC)
527   131 FORMAT('0NUMBER OF HEIGHT INCREMENTS ABOVE BEDROCK TO BE SEARCHED
528      1= ',I2,/,' THE INCREMENT VALUES ARE',/,20F10.2)
529   132 WRITE(6,112)ICOND
530   112 FORMAT('0','TEST IF MAJOR OR MINOR LITHOLOGY TYPE WANTED= ',I2)
531        IF(ICOND)12,12,11
532     11 WRITE(6,113)(MAJTS(I),I=1,ICOND)
533   113 FORMAT(' ','LITHOLOGY TYPE CODES ARE',/,8I5)
534     12 WRITE(6,114)ICOL
535   114 FORMAT('0','TEST IF MAJOR OR MINOR COLOR OF LITHOLOGY WANTED=',I3)
536        IF(ICOL)14,14,13
537     13 WRITE(6,115)(MACOL(I),I=1,ICOL)
538   115 FORMAT(' ','LITHOLOGY COLOR CODES ARE',/,8I5)
539     14 WRITE(6,117)ILVL
540   117 FORMAT('0','TEST IF WATERLEVEL OF SATURATED ZONE IS TO BE USED= ',
541      1I2)
542        WRITE(6,121)KSAT
543   121 FORMAT('0TEST IF SATURATED ZONE IS TO BE LOGGED= ',I2)
544        WRITE(6,118)ILOG
545   118 FORMAT('0','TEST IF ALL LAYERS ARE TO BE LOGGED= ',I2)
546        IF(IGSUB)124,124,122
547   122 WRITE(6,123)IGSUB
548   123 FORMAT('0STEP DOWN INCREMENT FROM GROUND SURFACE ELEVATION= ',I2,
549      1' FEET')
550   124 IF(KTESK)129,129,125
551   125 WRITE(6,126)KTESK
552   126 FORMAT('0NUMBER OF K-PERMEABILITY AND S-STORAGE COEF. VALUES= ',I2
553      1)
554        WRITE(6,127)(AKVAL(I),I=1,KTESK)
555   127 FORMAT(' ','THE K-PERMEABILITY VALUES ARE',/,10F8.0)
556        WRITE(6,128)(SVAL(I),I=1,KTESS)
557   128 FORMAT(' ','THE S-STORAGE COEF. VALUES ARE',/,10F8.3)
558   129 WRITE(6,119)(IPUNH(I),I=1,6)
559   119 FORMAT('0','TEST FOR PUNCHING DATA',//,5X,'LAYER DATA= ',I2,/,5X,'
560      1NET THICKNESS= ',I2,/,5X'TEST HOLE DATA= ',I2,/,5X,'COLOR OF LITHOLOGY=
561      1 ',I2,/,5X,'MATERIAL TYPE OF LITHOLOGY= ',I2,/,5X,' WGT. AVE. PERM
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562          2. AND WGT. AVE. STOR. COEF.= ',I2)
563          RETURN
564          END
565    C
566    C
567    C     SUBROUTINE KTESX COMPUTES AVERAGE K AND S VALUES WEIGHTED ON LAYER
568    C     THICKNESS
569          SUBROUTINE KTESX(ILAY,S7,S8,AKV1,SV1)
570          COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
571          COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
572          COMMON ISEC,ISEC1,ISEC2,AKVAL(10),SVAL(10),KTEST,KSAT,LTEST
573          IF(LTEST)10,10,15
574    10    S7=0.0
575          S8=0.0
576          AKV1=0.0
577          SV1=0.0
578          LTEST=LTEST+1
579    15    J7=STRAT(ILAY,7)
580          J8=STRAT(ILAY,6)
581          IF(J7)21,21,20
582    20    S7=S7+STRAT(ILAY,2)
583          AKV1=AKV1+(AKVAL(J7)*STRAT(ILAY,2))
584    21    IF(J8)26,26,25
585    25    S8=S8+STRAT(ILAY,2)
586          SV1=SV1+(SVAL(J8)*STRAT(ILAY,2))
587    26    RETURN
588          END
589    C
590    C
591          SUBROUTINE COLOR(ICOLR,NWELL,MACOL,IPUNH)
592    C     SUBROUTINE TO READ AND TEST FOR MAJOR OR MINOR COLOR OF LITHOLOGY
593          DIMENSION MACOL(10)
594          COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
595          COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
596          COMMON ISEC,ISEC1,ISEC2
597    100   FORMAT(' ','HOLE NO.',2X,'LAYER NO.',2X,'MAJOR COLOR',2X,'MINOR CO
598         1LOR',4X,'ELEV ',3X,'DEPTH',3X,'THICKNESS',5X,'NET THICK(MAJOR)   NE
599         2T THICK(MINOR)')
600    101   FORMAT(' ',2X,I3,8X,I2,10X,I2,20X,F6.1,2XF6.1,6X,F6.2)
601    102   FORMAT(' ',2X,I3,8X,I2,23X,I2,7X,F6.1,2X,F6.1,6X,F6.2)
602    103   FORMAT('+',80X,F6.2)
603    104   FORMAT('+',99X,F6.2)
604    C     WRITE HEADERS FOR COLORS FOUND IN LITHOLOGY
605          WRITE(6,100)
606    C     ICOLR IS THE NUMBER OF COLORS SELECTED
607          DO 6 K=1,ICOLR
608    C     MACOL(K) IS THE NUMERICAL CODE FOR EACH COLOR SELECTED
609          JTEST=MACOL(K)
610    C     NWELL IS THE NUMBER OF TEST HOLES TO BE SEARCHED
611          DO 5 IC=1,NWELL
612    C     CALLS SUBROUTINE NAMED 'SERCH'
613          CALL SERCH(NLAY,GSELV,IC)
614    C     SETS SECTOR TO TEST HOLE NO. BEING SEARCHED
615          ISEC2=IWELL(IC)
616    C     READS FROM DISC LAYER DATA
617          READ (1'ISEC2)STRAT
618          SUM=0.0
619          SUM2=0.0
620          SUM3=0.0
621          J=1
622    C     SETS IWLL TO TEST HOLE NO. BEING SEARCHED
623    52    IWLL=IWELL(IC)
624    C     READS LAYER DATA FOR ALL LAYERS IN EACH TEST HOLE
625    53    DO 4 JJ=1,NLAY
626    C     SETS TYPE TO COLOR OF LAYER
627    50    TYPE=STRAT(J,4)
628    C     SETS THICK TO THICKNESS OF LAYER BEING SEARCHED
629          THICK=STRAT(J,2)
630    C     SUMS LAYER THICKNESS OF ALL LAYERS AS SEARCHED
631          SUM=SUM+STRAT(J,2)
632    C     KTEST IS A THREE DIGIT NUMBER (COLOR CODE) OF LAYER
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633            KTEST= IFIX(TYPE)/10
634    C       TEST IF COLOR IN LAYER IS SELECTED COLOR
635            IF (KTEST-JTEST) 2, 1, 2
636    C       SUM1 IS THE THICKNESS TO TOP OF LAYER WHERE COLOR IS FOUND
637       1 SUM1=SUM-STRAT(J,2)
638            SUM2=SUM2+THICK
639    C       COMPUTES ELEVATION OF TOP OF LAYER WHERE COLOR IS FOUND
640            ELEV=GSELV-SUM1
641    C       ICOL IS TWO NUMBER CODE
642            ICOL = TYPE
643    C       LABELS HOLE NO., LAYER NO., COLOR CODE, ELEV OF TOP OF LAYER, DEPTH TO
644    C       LAYER, LAYER THICKNESS
645            WRITE(6,101)IWLL,      JJ,ICOL,ELEV,SUM1,THICK
646    C       TEST FOR PUNCHED OUTPUT
647            IF(IPUNH)4,4,10
648    C       PUNCHES HOLE NO., LAYER NO., COLOR CODE, ELEV. OF TOP OF LAYER, DEPTH
649    C       TO LAYER, LAYER THICKNESS ON ONE CARD
650      10 WRITE(7,11)IWLL,JJ,ICOL,ELEV,SUM1,THICK
651      11 FORMAT(' COLOR1 ',3I5,F6.1,2X,F6.1,6X,F6.2)
652            GO TO 4
653       2 KTEST=TYPE-FLOAT(KTEST)*10.
654    C       TEST IF COLOR ASKED FOR IS MINOR COLOR
655            IF(KTEST-JTEST)4,3,4
656    C       CALCULATES DEPTH TO TOP OF LAYER
657       3 SUM1=SUM-STRAT(J,2)
658            SUM3=SUM3+THICK
659    C       CALCULATES ELEV. TOP OF LAYER
660            ELEV=GSELV-SUM1
661    C       ICOL IS A TWO NUMBER CODE
662            ICOL=TYPE
663    C       LABELS HOLE NO., LAYER NO., COLOR CODE, ELEV OF TOP OF LAYER, DEPTH
664    C       TO LAYER, LAYER THICKNESS
665            WRITE(6,102)IWLL,      JJ,ICOL,ELEV,SUM1,THICK
666            IF(IPUNH)4,4,12
667    C       PUNCHES HOLE NO., LAYER NO., COLOR CODE, ELEV OF TOP OF LAYER, DEPTH
668    C       TO LAYER, LAYER THICKNESS ON ONE CARD
669      12 WRITE(7,13)IWLL,JJ,ICOL,ELEV,SUM1,THICK
670      13 FORMAT( 'COLOR2 ',3I5,F6.1,2X,F6.1,6X,F6.2)
671       4 J=J+1
672            IF(SUM2)55,55,54
673      54 WRITE(6,103)SUM2
674      55 IF(SUM3)5,5,56
675      56 WRITE(6,104)SUM3
676       5 CONTINUE
677       6 CONTINUE
678            RETURN
679            END
680    C
681    C
682            SUBROUTINE SERCH(NLAY,GSELV,IC)
683    C       SUBROUTINE READS FROM DISC (1) TOTAL NO. OF LAYERS, (2) GROUND
684    C       SURFACE ELEVATION FOR SELECTED TEST HOLE
685            COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
686            COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,9)
687            COMMON ISEC,ISEC1,ISEC2
688    C       SET SECTOR NUMBER TO READ TOTAL NO. OF LAYERS FROM DISC
689            IBRN=0
690            ISEC=21
691    3001 READ(2'ISEC)WVAR
692            IKKK=IWELL(IC)
693            IF(IBRN)10,10,3002
694      10 NLAY=WVAR(IKKK)
695    C       SET SECTOR NUMBER TO READ GROUND SURFACE ELEV. FROM DISC
696            ISEC=6
697            IBRN=1
698            GO TO 3001
699    C       SETS GSELV TO GROUND SURFACE ELEVATION
700    3002 GSELV=WVAR(IKKK)
701            RETURN
702            END
703    C
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704    C
705            SUBROUTINE MATRL (ICOND,NWELL,MAJTS,IPUNH)
706    C      SUBROUTINE SELECTS MAJOR AND MINOR MATERIAL TYPE OF
707    C      LITHOLOGY
708            DIMENSION MAJTS (10)
709            COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
710            COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
711            COMMON ISEC,ISEC1,ISEC2
712       100 FORMAT(' ', 'HOLE NO.',2X,'LAYER NO',2X,'MAJOR TYPE',3X, 'MINOR TY
713           1PE',5X,'ELEV',4X,'DEPTH',3X,'THICKNESS',5X,'NET THICK(MAJOR)   NET
714           2THICK(MINOR)')
715       101 FORMAT(' ',2X,I3,8X,I2,10X,I5,18X,F6.1,2X,F6.1,6X,F6.2)
716       102 FORMAT(' ',2X,I3,8X,I2,22X,I5,6X,F6.1,2X,F6.1,6X,F6.2)
717       103 FORMAT('+',80X,F6.2)
718       104 FORMAT('+',99X,F6.2)
719            WRITE(6,100)
720    C      ICOND IS THE NUMBER OF MATERIAL TYPES SELECTED.
721            DO 6 K=1,ICOND
722    C      SETS JTEST EQUAL TO MATERIAL CODE SELECTED (2 DIGIT)
723            JTEST=MAJTS(K)
724    C      SEARCH THROUGH EACH SELECTED TEST HOLE
725            DO 5 IC=1,NWELL
726    C      CALLS SUBROUTINE SERCH
727            CALL SERCH (NLAY,GSELV,IC)
728            ISEC2=IWELL(IC)
729    C      READ LAYER DATA FROM DISC FOR EACH HOLE
730            READ (1'ISEC2)STRAT
731            SUM=0.0
732            J=1
733            SUM2=0.0
734            SUM3=0.0
735        52 IWLL=IWELL(IC)
736    C      SEARCH ALL LAYERS IN EACH HOLE
737        53 DO 4 JJ=1,NLAY
738    C      SET TYPE EQUAL TO MATERIAL CODE FOR EACH LAYER (5 DIGIT)
739        50 TYPE=STRAT(J,3)
740    C      SUM IS THE TOTAL THICKNESS INCLUDING THE LAYER BEING SEARCHED
741            SUM=SUM+STRAT(J,2)
742    C      SETS KTEST TO A TWO DIGIT CODE OF MAJOR MATERIAL TYPE
743            KTEST=IFIX(TYPE)/1000
744    C      THICK IS THE THICKNESS OF LAYER BEING SEARCHED
745            THICK=STRAT(J,2)
746    C      TEST IF MAJOR MATERIAL TYPE IS IN SELECTED LAYER
747            ID1=TYPE/10000.
748            IF(ID1-2)1002,30,1002
749        30 ITYPE=TYPE/1000.
750            ID2=ITYPE-(ITYPE/10*10)
751            IF(ID2-2)34,31,34
752        31 ITEST=ID2+10
753      1000 IF(ITEST-JTEST)32,1,32
754        32 ITYPE=TYPE/10.
755            ID4=ITYPE-(ITYPE/10*10)
756      1001 IF(ID4-2)35,33,35
757        33 ITEST=ID4+10
758            IF(ITEST-JTEST)4,1,4
759        34 ITYPE=TYPE/100.
760            ID23=ITYPE-(ITYPE/100*100)
761            IF(ID23-JTEST)1001,1,1001
762        35 ITYPE=TYPE
763            ITEST=ITYPE-(ITYPE/100*100)
764            IF(ITEST-JTEST)4,1,4
765      1002 IF(KTEST-JTEST)2,1,2
766    C      SUM1 IS THE DEPTH TO TOP OF LAYER WHERE MAJOR TYPE IS FOUND
767         1 SUM1=SUM-STRAT(J,2)
768    C      SUM2 IS THE TOTAL THICKNESS OF LAYERS WITH MAJOR TYPE
769            SUM2=SUM2+THICK
770    C      ELEV IS ELEVATION OF TOP OF LAYER CONTAINING MAJOR TYPE
771            ELEV=GSELV-SUM1
772    C      SETS TYPE TO AN INTEGER NUMBER
773            ITYPE=TYPE
774    C      LABELS HOLE NO., LAYER NO., MAJOR MATERIAL TYPE, ELEV. OF TOP OF
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775   C      LAYER, DEPTH TO LAYER, LAYER THICKNESS
776          WRITE(6,101) IWLL,      JJ,ITYPE,ELEV,SUM1,THICK
777   C      TEST FOR PUNCHED OUTPUT
778          IF(IPUNH)4,4,7
779   C      PUNCHES HOLE NO., LAYER NO., MAJOR MATERIAL TYPE, ELEV. OF TOP OF
780   C      LAYER, DEPTH TO LAYER, LAY THICK
781        7 WRITE(7,8)IWLL,JJ,ITYPE,ELEV,SUM1,THICK
782        8 FORMAT('MAJOR',3I6,2F8.1,F10.2)
783          GO TO 4
784   C      BREAK DOWN TYPE OF MATERIAL CODE TO TWO DIGITS
785        2 INUM=TYPE/1000.
786          ITYPE=TYPE
787   C      BREAK DOWN TYPE OF MATERIAL CODE TO MINOR TYPE ONLY
788   C      TEST IF MINOR TYPE OF MATERIAL CODE CALLED IS IN LAYER
789          INUM=TYPE-(FLOAT(INUM)*1000.)
790          IADJ=INUM/100
791          IF(IADJ-1)21,20,21
792       20 KTEST=INUM/10
793          GO TO 22
794       21 KTEST=INUM-(IADJ*100)
795       22 IF(KTEST-JTEST)4,3,4
796   C      SUM1 IS THE DEPTH TO TOP OF LAYER WHERE MINOR TYPE CODE IS FOUND
797        3 SUM1=SUM-STRAT(J,2)
798          SUM3=SUM3+THICK
799   C      ELEV IS THE ELEVATION OF TOP OF LAYER WHERE MINOR TYPE IS FOUND
800          ELEV=GSELV-SUM1
801   C      LABELS WELL NO., LAYER NO., MINOR MATERIAL TYPE, ELEV OF TOP OF
802   C      LAYER, LAYER THICK
803          WRITE(6,102) IWLL,      JJ,ITYPE,ELEV,SUM1,THICK
804          IF(IPUNH)4,4,9
805        9 WRITE(7,10)IWLL,JJ,ITYPE,ELEV,SUM1,THICK
806       10 FORMAT('MINOR',3I6,2F8.1,F10.2)
807        4 J=J+1
808   C      TEST IF NET THICKNESS OF LAYERS WITH MAJOR MATERIAL IS SELECTED
809          IF(SUM2)55,55,54
810   C      WRITE NET THICKNESS OF LAYERS WITH MAJOR MATERIAL TYPE
811       54 WRITE(6,103)SUM2
812       55 IF(SUM3)5,5,56
813       56 WRITE(6,104)SUM3
814        5 CONTINUE
815        6 CONTINUE
816          RETURN
817          END
818   C
819   C
820          SUBROUTINE TAPES
821   C      SUBROUTINE TAPES READS TAPES USED IN STORAGE AND RETRIEVAL PROGRAM
822   C      TAPE NUMBER 8 FOR WELL VARIABLE DATA.
823   C      TAPE DRIVE NUMBER 9 FOR LAYER DATA.
824          COMMON IWELL(1000),IVAR(8),TVALU(8),IADV(8),WVAR(1000),ISTOR(21)
825          COMMON HEAD(2,252),TITLE(2,108),JWELL(1000),IADVR(8),STRAT(20,8)
826          COMMON ISEC,ISEC1,ISEC2
827          ISEC1=1
828          DO 10 I=1,21
829   C      READS TEST HOLE DATA VARIABLES FROM TAPE
830          READ(8,END=11)WVAR
831   C      WRITES TEST HOLE DATA ON DISC FILE
832       10 WRITE(2'ISEC1)WVAR
833       11 DO 20 J=1,1000
834   C      READS LAYER DATA VARIABLES FROM TAPE
835          READ(9,END=30)IM,I,STRAT
836   C      SELECTS LAYER VARIABLES FOR SPECIFIED TEST HOLES
837          IF(IM)30,30,20
838   C      WRITE(LAYER DATA ON DISC)
839       20 WRITE(1'IM)STRAT
840       30 RETURN
841          END
842   C
843   C
844   C      SUBROUTINE JULDY COMPUTES JULIAN DATE FROM CALENDAR DATE AND MILITARY
845   C      TIME.
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846          SUBROUTINE JULDY (IMO,IDY,IYR,IHR,TIME)
847          NYR=IYR/4
848          NYR=NYR*4
849          IF (NYR-IYR) 2,1,2
850        1 IB=1
851          GO TO 3
852        2 IB=2
853        3 JDAY=0
854          DO 10 I=1,IMO
855          GO TO (4,5,6,5,9,5,9,5,5,9,5,9),I
856        4 MO=0
857          GO TO 10
858        5 MO=31
859          GO TO 10
860        6 GO TO (7,8),IB
861        7 MO=29
862          GO TO 10
863        8 MO=28
864          GO TO 10
865        9 MO=30
866       10 JDAY=JDAY+MO
867          JDAY=JDAY+IDY
868          DAY=JDAY-1
869          DAY=DAY*1440.
870          HR=(IHR/100)*60
871          HR1=IHR-((IHR/100)*100)
872          TIME=DAY+HR+HR1
873      102 RETURN
874          END
875  C
876  C
877  C      SUBROUTINE WATLV COMPUTES GROUND WATER ELEVATION AT SELECTED TEST HOLES
878  C      WHEN DATA FROM THE SATURATED ZONE IS RETRIEVED
879          SUBROUTINE WATLV(NWELLS,IWELL,WATEL)
880  C      WATER LEVEL PROGRAM COMPUTES AVERAGE GROUND WATER ELEVATION FOR A SELECTED
881  C      TIME PERIOD.
882          DIMENSION IWELL(1000),WATEL(1000)
883          REWIND 4
884          JWELL1=0
885  C      BEGINNING (IMO, IDY, IYR, ITIM) AND ENDING (JMO, JDY, JYR, JTIM) MONTH,
886  C      DAY, YEAR, MILITARY TIME OF PERIOD FOR WHICH AVERAGE WATER LEVEL IS
887  C      COMPUTED IS READ FROM DATA CARD
888        1 READ(5,101)IMO,IDY,IYR,ITIM,JMO,JDY,JYR,JTIM
889      101 FORMAT(16I5)
890          WRITE(6,110)IMO,IDY,IYR,ITIM,JMO,JDY,JYR,JTIM
891      110 FORMAT('0',25('*'),'TIME PERIOD FOR SEASONAL ',I2,'/',I2,'/',I2,'/
892         1',I4,' TO ',I2,'/',I2,'/',I2,'/',I4,1X,25('*'),//)
893          IIYR=IYR
894          IF(IMO)107,107,5
895  C      SUBROUTINE JULDY COMPUTES TIME IN MINUTES FROM MONTH, DAY, YEAR, AND
896  C      MILITARY TIME
897  C      BTIM-BEGINNING TIME (JULIAN DATE IN MINUTES) OF PERIOD FOR WHICH WATER
898  C            LEVELS ARE AVERAGED
899        5 CALL JULDY(IMO,IDY,IYR,ITIM,BTIM)
900          IF(IYR-JYR)2,3,3
901  C      EYEAR-WHEN PERIOD FOR WHICH WATER LEVELS ARE AVERAGED CROSSES END OF YEAR
902  C            THEN EYEAR (END OF FIRST YEAR, JULIAN DATE IN MINUTES) IS CALUCLATED
903        2 CALL JULDY(12,31,IYR,2359,EYEAR)
904      500 IIYR=IIYR+1
905          IF(IIYR-JYR)501,502,502
906  C      STIME-WHEN PERIOD FOR WHICH WATER LEVELS ARE AVERAGED SPANS A FULL YEAR
907  C            THAT YEARS TIME (JULIAN DATE IN MINUTES) IS CALCULATED
908      501 CALL JULDY(12,31,IIYR,2359,STIME)
909          EYEAR=EYEAR+STIME
910          GO TO 500
911  C      EETIM-THE JULIAN DATE IN MINUTES FROM JANURARY 1 OF THE FINAL YEAR TO THE
912  C      END OF THE SELECTED TIME PERIOD
913      502 CALL JULDY(JMO,JDY,JYR,JTIM,EETIM)
914          ETIME=EETIM
915          ETIM=EETIM+EYEAR
916          GO TO 6
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917  C      ETIM-END OF SELECTED PERIOD (JULIAN DATE IN MINUTES)
918     3 CALL JULDY(JMO,JDY,JYR,JTIM,ETIM)
919       ETIME=ETIM
920  C      TTIM-TOTAL TIME (MINUTES) OF SELECTED TIME PERIOD
921     6 TTIM=ETIM-BTIM
922  C      RATE OF WATER LEVEL CHANGE IS COMPUTED FROM ELEVATIONS READ FROM TAPE
923  C      WITHIN THE SELECTED TIME PERIOD.
924       DO 1110 I=1,NWELLS
925       IF(IWELL(I)-JWELL1)7,1000,8
926     7 REWIND 4
927       JWELL1=0
928     8 KKK=IWELL(I)
929       JBRN=1
930       JBN=1
931       STIM=0.0
932       SGH=0.0
933       TIMZ=0.0
934       TM=0.0
935    10 READ(4,END=107) NWELL,NCODE,NYR,NMO,NDY,NTIM,ELEV
936       IF(NWELL-IWELL(I))10,20,85
937    20 CALL JULDY(NMO,NDY,NYR,NTIM,TIME)
938       GO TO(3000,3001),JBRN
939  3000 JBRN=2
940       IF(IYR-NYR)86,30,3010
941  3001 IF(IYR-NYR)40,30,3010
942    30 IF(BTIM-TIME)3003,3002,3010
943  3002 WGH=0.0
944       ELEV2=ELEV
945       TIMEB=TIME
946       GO TO 3011
947  3003 IF(NYR1-NYR)3005,3004,3004
948  3004 JBN=2
949       GO TO 40
950  3005 JBN=3
951       GO TO 40
952  3010 NYR1=NYR
953       GO TO 10
954    40 BACKSPACE 4
955       BACKSPACE 4
956       READ(4,END=107)NWELL,NCODE,NYR,NMO,NDY,NTIM,ELEV1
957       CALL JULDY(NMO,NDY,NYR,NTIM,TIMA)
958    45 READ(4,END=107)KWELL,KCODE,KYR,KMO,KDY,KTIM,ELEV2
959       IF(KWELL-IWELL(I))86,46,87
960    46 IF((KYR-NYR)-1)3014,3013,3012
961  C      A BREAK IN RECORD GREATER THAN ONE YEAR IS PRINTED IN OUTPUT
962  3012 WRITE(6,109)IWELL(I),NMO,NDY,NYR,NTIM,KMO,KDY,KYR,KTIM
963   109 FORMAT(' WELL NUMBER ',I4,' BREAK IN RECORD FROM ',3I3,I5,' TO ',
964      13I3,I5)
965       GO TO 1005
966  3013 IF(KMO+(12-NMO)-12)3014,3012,3012
967  3014 CALL JULDY(KMO,KDY,KYR,KTIM,TIMEB)
968       GO TO(206,207,3006),JBN
969  3006 CALL JULDY(12,31,NYR,2359,TM)
970       DIFF=((TM-TIMA)+BTIM)+(TIMEB-BTIM)
971       DIFF1=TIMEB-BTIM
972       GO TO 208
973   206 CALL JULDY(12,31,NYR,2359,TM)
974       DIFF=(TM-TIMA)+TIMEB
975       DIFF1=(TM-BTIM)+TIMEB
976       GO TO 208
977   207 DIFF=TIMEB-TIMA
978       DIFF1=TIMEB-BTIM
979   208 SLOPE=(ELEV2-ELEV1)/DIFF
980       GHA=ELEV2-(SLOPE*DIFF1)
981       DIFF=DIFF1
982       STIM=STIM+DIFF
983       IF(STIM-TTIM)1002,1011,1010
984  1010 DIFF=DIFF-(TM-ETIM+TIMEB)
985       GHB=ELEV2-SLOPE*(TM-ETIM+TIMEB)
986       GO TO 1012
987  1011 GHB=ELEV2-SLOPE*(TIMEB-ETIM)
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988    1012 WGH=(((GHA+GHB)*.5)*DIFF)/TTIM
989         GO TO 9001
990    1002 GHB=ELEV2
991         WGH=(((GHA+GHB)*.5)*DIFF)/TTIM
992    3011 SGH=SGH+WGH
993         GHA=ELEV2
994         TIMZ=TIMEB
995      50 READ(4,END=107)NWELL,NCODE,NYR,NMO,NDY,NTIM,GHB
996         IF(NWELL-IWELL(I))86,51,87
997      51 CALL JULDY(NMO,NDY,NYR,NTIM,TIMX)
998         IF(TIMZ-TIMX)201,201,200
999     200 CALL JULDY(12,31,NYR-1,2359,TM)
1000        DIFF=((TM-TIMZ)+TIMX)
1001        GO TO 203
1002     201 DIFF=TIMX-TIMZ
1003     203 STIM=STIM+DIFF
1004        IF(STIM-TTIM)55,800,70
1005      55 WGH=((((GHB+GHA)*.5)*DIFF)/TTIM)
1006        SGH=SGH+WGH
1007        GHA=GHB
1008        TIMZ=TIMX
1009        GO TO 50
1010     800 WGH=((((GHB+GHA)*.5)*DIFF)/TTIM)
1011        GHA=GHB
1012        TIMZ=TIMX
1013        GO TO 9001
1014      70 BACKSPACE 4
1015      80 BACKSPACE 4
1016        READ(4,END=107)NWELL,NCODE,NYR,NMO,NDY,NTIM,ELEV1
1017        IF(NWELL-IWELL(I))86,81,87
1018      81 GHA=ELEV1
1019        CALL JULDY(NMO,NDY,NYR,NTIM,TIMEA)
1020        READ(4,END=107)NWELL,NCODE,NYR1,NMO,NDY,NTIM,ELEV2
1021        CALL JULDY(NMO,NDY,NYR1,NTIM,TIMEB)
1022        IF(NYR1-NYR)805,805,801
1023     801 CALL JULDY(12,31,NYR,2359,TM1)
1024        DIFF=(TM1-TIMEA)+TIMEB
1025        SLOPE=(ELEV2-ELEV1)/DIFF
1026        IF(JYR-NYR)803,803,802
1027     802 GHB=ELEV2-(SLOPE*(TIMEB-ETIME))
1028        WGH=((((GHB+GHA)*.5)*((TM1-TIMEA) +ETIME))/TTIM)
1029        GO TO 9001
1030     803 GHB=ELEV1+(SLOPE*(ETIME-TIMEA))
1031        GO TO 9000
1032     805 SLOPE=(ELEV2-ELEV1)/(TIMEB-TIMEA)
1033        GHB=ELEV2-(SLOPE*(TIMEB-ETIME))
1034        IF(ETIME-TIMEA)9000,9009,9000
1035    9009 ETIME=TIMEB
1036    9000 WGH=((((GHB+GHA)*.5)*(ETIME-TIMEA))/TTIM)
1037    9001 WGHP=SGH+WGH
1038        GO TO 1006
1039   C    WHEN NO RECORD IS FOUND FOR SELECTED TIME PERIOD THIS IS PRINTED IN OUTPUT
1040      85 WRITE(6,103)IWELL(I),IMO,IDY,IYR,ITIM,JMO,JDY,JYR,JTIM
1041     103 FORMAT(' ',' WELL NO. ',I4,' NO RECORD FOR PERIOD OF ',3I3,I5,' TO
1042      1 ',3I3,I5)
1043        GO TO 1005
1044   C    WHEN SELECTED TIME PERIOD STARTS BEFORE RECORDS ON TAPE THIS IS PRINTED IN
1045   C    OUTPUT.
1046      86 WRITE(6,104)IWELL(I)
1047     104 FORMAT(' ',' WELL NO. ',I4,' PERIOD OF RECORD STARTS BEFORE ACTUAL
1048      1RECORD')
1049        GO TO 1005
1050   C    WHEN SELECTED TIME PERIOD GOES BEYOND RECORDS ON TAPE THIS IS PRINTED IN
1051   C    OUTPUT
1052      87 WRITE(6,105)IWELL(I)
1053     105 FORMAT(' ',' WELL NO. ',I4,' PERIOD OF RECORD BEYOND ACTUAL RECORD
1054      1')
1055   C    NUMBER 99999 STORED IN WATEL (KKK) INDICATES A MISSING RECORD FOR THESE
1056   C    SELECTED TIME PERIODS
1057    1005 WGHP=99999.
1058    1006 WATEL(KKK)=WGHP
```

```
1059     1000 JWELL1=IWELL(I)
1060     1110 CONTINUE
1061      107 RETURN
1062          END
1063   C
1064   C
1065   C     END OF RETRIEVAL PROGRAMS, STORAGE PROGRAMS FOLLOW.
1066   C
1067   C     **** STORAGE PROGRAM FOR TEST HOLE DATA ****
1068         DEFINE FILE 1(21,1000,U,IM)
1069         DIMENSION WELL1(1000),WELL(4),NN(4)
1070         DIMENSION ISTART(21)
1071         DO 105 I=1,21
1072      105 ISTART(I)=0
1073   C     READ FROM CARD THE NUMBER OF TEST HOLE VARIABLES TO BE STORED ON DISC
1074         READ(5,100) NOVAR
1075      100 FORMAT(I4)
1076   C     READ A VARIABLE NUMBER, FOUR VARIABLE VALUES, AND FOUR TEST HOLE
1077   C     NUMBERS FROM CARDS
1078       99 READ(5,200)NVAR,(NN(I),I=1,4),(WELL(I),I=1,4)
1079      200 FORMAT(I2,4I5,4F11.0)
1080         IF(NVAR)4,4,1
1081        1 IM=NVAR
1082         IF(ISTART(NVAR).EQ.0) GO TO 6
1083         READ(1'IM) WELL1
1084         IM=IM-1
1085         GO TO 8
1086        6 DO 7 I=1,1000
1087        7 WELL1(I)=0.
1088        8 DO 3 I=1,4
1089         IF(NN(I))3,3,2
1090        2 IW=NN(I)
1091         WELL1(IW)=WELL(I)
1092        3 CONTINUE
1093   C     WRITE TEST HOLE VARIABLE ON DISC
1094         WRITE(1'IM) WELL1
1095         ISTART(NVAR)=1
1096         GO TO 99
1097   C     WRITE TEST HOLE VARIABLE DATA FROM DISC TO TAPE
1098        4 IM=1
1099         DO 5 I=1,NOVAR
1100         READ(1'IM) WELL1
1101         WRITE(9) WELL1
1102   C     WRITE VARIABLE NUMBER, TEST HOLE NUMBER, AND VARIABLE VALUE'ON PRINTER
1103         WRITE(6,101)I,(J,WELL1(J),J=1,1000)
1104      101 FORMAT('0',,'VARIABLE NUMBER',I2,//,7(I4,2X,F11.0))
1105        5 CONTINUE
1106         WRITE(6,102)
1107      102 FORMAT ('1',,'TEST HOLE VARIABLE DATA HAS BEEN STORED ON TAPE')
1108         STOP
1109         END
1110   C
1111   C ,
1112   C
1113   C     **** STORAGE PROGRAM FOR LAYER DATA ****
1114         DEFINE FILE 1(1000,161,U,IM)
1115         DIMENSION STRAT(20,8),NWELLS(1000)
1116   C     NOWEL IS THE NUMBER OF TEST HOLES FOR WHICH DATA IS STORED
1117         READ(5,100)NOWEL
1118      100 FORMAT(I4)
1119         ICOUN=0
1120         DO 3 IC=1,NOWEL
1121   C     NWELL IS THE TEST HOLE NUMBER
1122   C     STRAT (1,J) IS THE LAYER VARIABLES STORED IN EACH LAYER
1123   C     NOLAY IS THE NUMBER OF THE LAYER FOR WHICH VARIABLES ARE STORED.
1124         READ(5,101)NWELL,(STRAT(1,J),J=1,8),NOLAY
1125      101 FORMAT(I4,2F4.0,1X,F5.0,2F3.0,2F7.0,F10.6,I4)
1126         IF(NWELL)200,200,300
1127      300 ICOUN=ICOUN+1
1128         IF(NOLAY-1)3,2,1
1129        1 READ(5,106)((STRAT(I,J),J=1,8),I=2,NOLAY)
```

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```
1130      106 FORMAT(4X,2F4.0,1X,F5.0,2F3.0,2F7.0,F10.6)
1131        2 WRITE(1'NWELL)NOLAY,STRAT
1132          NWELLS(IC)=NWELL
1133        3 CONTINUE
1134   C      SEQUENCE THE WELLS IN ASCENDING ORDER
1135      200 NUM=ICOUN-1
1136          DO 5 J=1,ICOUN
1137          DO 5 I=1,NUM
1138          IF(NWELLS(I)-NWELLS(I+1))5,5,4
1139        4 HOLD=NWELLS(I)
1140          NWELLS(I)=NWELLS(I+1)
1141          NWELLS(I+1)=HOLD
1142        5 CONTINUE
1143   C      WRITE LAYER DATA ON TAPE AND PRINTER
1144          DO 7 IC=1,ICOUN
1145          IM=NWELLS(IC)
1146          READ(1'IM)NOLAY,STRAT
1147          IU=IM-1
1148          WRITE(8) IU,NOLAY,STRAT
1149          DO 6 I=1,NOLAY
1151      103 FORMAT(' ',2I5,8F10.1)
1152        7 CONTINUE
1153          IM=0
1154          WRITE(8)IM,NOLAY,STRAT
1155          WRITE(6,104)
1156      104 FORMAT('1','LAYER DATA STORED ON TAPE')
1157          STOP
1158          END
1159   C
1160   C
1161   C      **** WATER LEVEL DATA STORAGE PROGRAM ****
1162   C      CALLS SUBROUTINE (TESTEL)
1163   C      PROGRAM STORES PUNCH CARD TAPE DOWN DATA AS WATER LEVEL ELEVATIONS ON
1164   C      MAGNETIC TAPE.
1165   C      MASTER TAPE OF WATER LEVEL ELEVATIONS IS CONSTRUCTED USING PIPE ELEVATIONS
1166   C      AND TAPE DOWN DATA STORED ON CARDS OR TAPES.
1167   C      WATER LEVEL DATA FOR SELECTED TEST HOLES CAN BE UPDATED USING THIS
1168   C      PROGRAM.
1169   C      TAPE PARAMETERS READ IN BY DATA STATEMENT
1170   C      WORDS-NUMBER OF WORDS WRITTEN PER RECORD
1171   C      LRECL-LENGTH OF RECORD SIZE
1172   C      BLKSIZ-BLOCK SIZE PARAMETER
1173   C      BPI-BITS PER INCH FOR OUTPUT TAPE
1174   C      RGAP-RECORD GAPE BETWEEN RECORDS (INCHES)
1176          REAL*4 LRECL,INPBK
1176          DIMENSION KWL(4),ELVX(4),ELVN(1000),ITEST(1000),JWELL(3)
1177          DIMENSION IWN(100),IMO(100),IDY(100),IYR(100),ELV(100)
1178          DIMENSION ITAPE(3),NMO(3),NDY(3),NYR(3),NTIM(3),EL(3)
1179          COMMON NYR,NMO,NDY,NTIM,EL,IYR,IMO,IDY,ELV,ELVN,ITEST,KTAPE,
1180         *NCODE,ICOUNT,IPAGE,IWN
1181          DATA WORDS,LRECL,BLKSIZ,BPI,RGAP/8.,24.,2400.,1600.,.75/
1182          DATA JWELL/3*0/
1183          DO 1 I=1,1000
1184          ITEST(I)=1
1185        1 ELVN(I)=0.0
1186   C      READ IN TOP OF PIPE ELEVATIONS FOR ALL TEST HOLES.
1187   C      IV-LAST CARD TEST
1188   C      KWL (I)-TEST HOLE NUMBERS.
1189   C      ELVX (I)-TOP OF PIPE ELEVATIONS AT EACH TEST HOLE.
1190        5 READ(5,1000)IV,(KWL(I),I=1,4),(ELVX(I),I=1,4)
1191     1000 FORMAT(I2,4I5,4F11.2)
1192          IF(IV.LE.0) GO TO 15
1193          DO 10 I=1,4
1194          IF(KWL(I).LE.0) GO TO 10
1195          KKK=KWL(I)
1196          ELVN(KKK)=ELVX(I)
1197       10 CONTINUE
1198          GO TO 5
1199   C      READ IN PIPE ELEVATIONS CHANGES
1200       15 I=1
1201   C      IWN (I)-TEST HOLE NUMBER
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1202  C      IMO (I), IDY (I), IYR (I) IS THE MONTH, DAY, AND YEAR OF PIPE ELEVATION
1203  C      (ELV (I)) CHANGES.
1204      16 READ(5,1001)IWN(I),IMO(I),IDY(I),IYR(I),ELV(I)
1205    1001 FORMAT(4I5,F10.2)
1206         IF(IWN(I).LE.0) GO TO 17
1207         ITEST(IWN(I))=0
1208         I=I+1
1209         GO TO 16
1210      17 NOBS1=I
1211  C      NTAPE-NUMBER OF TAPE DRIVE UNITS USED.
1212  C      ITAPE (I)-TAPE DRIVE UNIT NUMBERS.
1213  C      KTAPE-CREATED OR UPDATED TAPE UNIT NUMBER.
1214         READ(5,1002)NTAPE,(ITAPE(I),I=1,NTAPE),KTAPE
1215    1002 FORMAT(5I5)
1216  C      READ WELL NUMBER FROM TAPES FOR INITILIZATION.
1217    1005 DO 1006 IT=1,NTAPE
1218         ITP=ITAPE(IT)
1219         READ(ITP,103)JWELL(IT)
1220    1006 CONTINUE
1221    1007 WRITE(6,9999)(JWELL(I),I=1,NTAPE)
1222    .9999 FORMAT('0***** ',3I10,' *****'/)
1223  C      FOLLOWING TEST STATEMENTS SELECT DATA FROM TWO OR THREE DATA SETS AND
1224  C      ARRANGES THEM IN ORDER OF ASCENDING TEST HOLE NUMBERS FOR CREATING OR
1225  C      UPDATING DATA TAPE.
1226         IF(JWELL(1).EQ.0.AND.JWELL(2).EQ.0.AND.JWELL(3).EQ.0)GO TO 2000
1227         IF(JWELL(1).EQ.0.AND.JWELL(2).EQ.0.AND.JWELL(3).GT.0)GO TO 1060
1228         IF(JWELL(1).EQ.0.AND.JWELL(2).GT.0.AND.JWELL(3).EQ.0)GO TO 1050
1229         IF(JWELL(1).GT.0.AND.JWELL(2).EQ.0.AND.JWELL(3).EQ.0)GO TO 1030
1230         IF(JWELL(1).EQ.0.AND.JWELL(2).EQ.JWELL(3)) GO TO 1040
1231         IF(JWELL(1).EQ.0.AND.JWELL(2).LT.JWELL(3)) GO TO 1050
1232         IF(JWELL(1).EQ.0.AND.JWELL(2).GT.JWELL(3)) GO TO 1060
1233         IF(JWELL(2).EQ.0.AND.JWELL(1).EQ.JWELL(3)) GO TO 1020
1234         IF(JWELL(2).EQ.0.AND.JWELL(1).LT.JWELL(3)) GO TO 1030
1235         IF(JWELL(2).EQ.0.AND.JWELL(1).GT.JWELL(3)) GO TO 1060
1236         IF(JWELL(3).EQ.0.AND.JWELL(1).EQ.JWELL(2)) GO TO 1010
1237         IF(JWELL(3).EQ.0.AND.JWELL(1).LT.JWELL(2)) GO TO 1030
1238         IF(JWELL(3).EQ.0.AND.JWELL(1).GT.JWELL(2)) GO TO 1050
1239         IF(JWELL(1).EQ.JWELL(2).AND.JWELL(2).EQ.JWELL(3)) GO TO 1009
1240         IF(JWELL(1).EQ.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1010
1241         IF(JWELL(1).LT.JWELL(2).AND.JWELL(1).EQ.JWELL(3)) GO TO 1020
1242         IF(JWELL(1).LT.JWELL(2).AND.JWELL(2).EQ.JWELL(3)) GO TO 1030
1243         IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).EQ.JWELL(3)) GO TO 1040
1244         IF(JWELL(1).LT.JWELL(2).AND.JWELL(1).LT.JWELL(3)) GO TO 1050
1245         IF(JWELL(1).LT.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1030
1246         IF(JWELL(1).LT.JWELL(2).AND.JWELL(2).GT.JWELL(3)) GO TO 1030
1247         IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).LT.JWELL(3)) GO TO 1050
1248         IF(JWELL(1).GT.JWELL(2).AND.JWELL(2).GT.JWELL(3)) GO TO 1060
1249         WRITE(6,1008)
1250    1008 FORMAT('0','THERE ARE NO TEST COMBINATIONS FOR THESE TEST HOLES.'/)
1251         GO TO 2000
1252    1009 DO 34 IT=1,NTAPE
1253         ITP=ITAPE(IT)
1254         IF(ITAPE(IT).EQ.0) GO TO 34
1255         BACKSPACE ITP
1256         NWELL1=JWELL(ITP)
1257      20 IF(ITP.EQ.1) GO TO 21
1258         READ(ITP,103,END=30)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
1259        1),I=1,3)
1260         IREAD=3
1261     103 FORMAT(I4,I2,3(1X,3I2,I5,F7.2))
1262         GO TO 22
1263      21 READ(ITP,104,END=30)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
1264     104 FORMAT(I4,4I2,I4,F8.2)
1265         IREAD=1
1266      22 IF(NWELL1.NE.NWELL) GO TO 25
1267         CALL TESTEL(NWELL,NOBS1,IREAD)
1268         NWELL1=NWELL
1269         GO TO 20
1270      25 JWELL(ITP)=NWELL
1271         GO TO 34
1272      30 JWELL(ITP)=0
```

```
1273           ITAPE(IT)=0
1274        34 CONTINUE
1275           GO TO 1007
1276      1010 DO 45 IT=1,2
1277           ITP=ITAPE(IT)
1278           IF(ITAPE(IT).EQ.0) GO TO 45
1279           BACKSPACE ITP
1280           NWELL1=JWELL(ITP)
1281        35 IF(ITP.EQ.1) GO TO 36
1282           READ(ITP,103,END=41)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
1283          1),I=1,3)
1284           IREAD=3
1285           GO TO 37
1286        36 READ(ITP,104,END=41)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
1287           IREAD=1
1288        37 IF(NWELL1.NE.NWELL) GO TO 40
1289           CALL TESTEL(NWELL,NOBS1,IREAD)
1290           NWELL1=NWELL
1291           GO TO 35
1292        40 JWELL(ITP)=NWELL
1293           GO TO 45
1294        41 JWELL(ITP)=0
1295           ITAPE(IT)=0
1296        45 CONTINUE
1297           GO TO 1007
1298      1020 DO 65 IT=1,2
1299           GO TO (50,51),IT
1300        50 ITP=ITAPE(1)
1301           IF(ITAPE(1).EQ.0)GO TO 65
1302           GO TO 52
1303        51 ITP=ITAPE(3)
1304           IF(ITAPE(3).EQ.0)GO TO 65
1305        52 BACKSPACE ITP
1306           NWELL1=JWELL(ITP)
1307        55 IF(ITP.EQ.1) GO TO 56
1308           READ(ITP,103,END=61)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
1309          1),I=1,3)
1310           IREAD=3
1311           GO TO 57
1312        56 READ(ITP,104,END=61)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
1313           IREAD=1
1314        57 IF(NWFLL1.NE.NWELL) GO TO 60
1315           CALL TESTEL(NWELL,NOBS1,IREAD)
1316           NWELL1=NWELL
1317           GO TO 55
1318        60 JWELL(ITP)=NWELL
1319           GO TO 65
1320        61 JWELL(ITP)=0
1321           ITAPE(ITP)=0
1322        65 CONTINUE
1323           GO TO 1007
1324      1030 ITP=ITAPE(1)
1325           IF(ITAPE(1).EQ.0) GO TO 1007
1326           BACKSPACE ITP
1327           NWELL1=JWELL(ITP)
1328        70 IF(ITP.EQ.1) GO TO 71
1329           READ(ITP,103,END=80)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
1330          1),I=1,3)
1331           IREAD=3
1332           GO TO 72
1333        71 READ(ITP,104,END=80)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
1334           IREAD=1
1335        72 IF(NWFLL1.NE.NWELL) GO TO 75
1336           CALL TESTEL(NWELL,NOBS1,IREAD)
1337           NWELL1=NWELL
1338           GO TO 70
1339        75 JWELL(ITP)=NWELL
1340           GO TO 1007
1341        80 JWELL(ITP)=0
1342           ITAPE(1)=0
1343           GO TO 1007
```

```
1344    1040 DO 100 IT=1,2
1345         GO TO(85,86),IT
1346      85 ITP=ITAPE(2)
1347         IF(ITAPE(2).EQ.0)GO TO 100
1348         GO TO 87
1349      86 ITP=ITAPE(3)
1350         IF(ITAPE(3).EQ.0)GO TO 100
1351      87 BACKSPACE ITP
1352         NWELL1=JWELL(ITP)
1353      90 IF(ITP.EQ.1) GO TO 91
1354         READ(ITP,103,END=96)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(I
1355        1),I=1,3)
1356         IREAD=3
1357         GO TO 92
1358      91 READ(ITP,104,END=96)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1)
1359         IREAD=1
1360      92 IF(NWELL1.NE.NWELL) GO TO 95
1361         CALL TESTEL(NWELL,NOBS1,IREAD)
1362         NWELL1=NWELL
1363         GO TO 90
1364      95 JWELL(ITP)=NWELL
1365         GO TO 100
1366      96 JWELL(ITP)=0
1367         ITAPE(ITP)=0
1368     100 CONTINUE
1369         GO TO 1007
1370    1050 ITP=ITAPE(2)
1371         IF(ITAPE(2).EQ.0)GO TO 115
1372         BACKSPACE ITP
1373         NWELL1=JWELL(ITP)
1374     105 IF(ITP.EQ.1) GO TO 106
1375         READ(ITP,103,END=111)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(
1376        11),I=1,3)
1377         IREAD=3
1378         GO TO 107
1379     106 READ(ITP,104,END=111)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1
1380        *)
1381         IREAD=1
1382     107 IF(NWELL1.NE.NWELL) GO TO 110
1383         CALL TESTEL(NWELL,NOBS1,IREAD)
1384         NWELL1=NWELL
1385         GO TO 105
1386     110 JWELL(ITP)=NWELL
1387         GO TO 115
1388     111 JWELL(ITP)=0
1389         ITAPE(ITP)=0
1390     115 CONTINUE
1391         GO TO 1007
1392    1060 ITP=ITAPE(3)
1393         IF(ITAPE(3).EQ.0)GO TO 130
1394         BACKSPACE ITP
1395         NWELL1=JWELL(ITP)
1396     120 IF(ITP.EQ.1) GO TO 121
1397         READ(ITP,103,END=126)NWELL,NCODE,(NMO(I),NDY(I),NYR(I),NTIM(I),EL(
1398        11),I=1,3)
1399         IREAD=3
1400         GO TO 122
1401     121 READ(ITP,104,END=126)NWELL,NCODE,NMO(1),NDY(1),NYR(1),NTIM(1),EL(1
1402        *)
1403         IREAD=1
1404     122 IF(NWELL1.NE.NWELL) GO TO 125
1405         CALL TESTEL(NWELL,NOBS1,IREAD)
1406         NWELL1=NWELL
1407         GO TO 120
1408     125 JWELL(ITP)=NWELL
1409         GO TO 130
1410     126 JWELL(ITP)=0
1411         ITAPE(ITP)=0
1412     130 CONTINUE
1413         GO TO 1007
1414    C        COMPUTES THE NUMBER OF FEET OF TAPE USED TC STORE WATER LEVEL ELEVATIONS
```

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1415   C      AND THE NUMBER OF RECORDS STORED.
1416    2000 RECD=ICOUNT
1417         RECDS=BLKSIZ/LRECL
1418         INPBK=((WORDS*BLKSIZ)/BPI)+RGAP
1419         FT=((RECD/RECDS)*INPBK)/12.
1420         WRITE(6,2001) ICOUNT,KTAPE,FT
1421    2001 FORMAT('0',' $$$$$  ',I7,' NUMBER OF OBSERVATIONS WRITTEN ON TAPE ',I2,
1422        *'  $$$$$'/,6X,'FEET USED TO STORE DATA ON THIS TAPE IS ',F6.1)
1423         REWIND KTAPE
1424         STOP
1425         END
1426   C
1427   C
1428   C      SUBROUTINE TESTEL CALCULATES WATER LEVEL ELEVATIONS AND WRITES ON UPDATED
1429   C      TAPE.
1430         SUBROUTINE TESTEL(NWELL,NOBS1,IREAD)
1431         COMMON NYR(3),NMO(3),NDY(3),NTIM(3),EL(3),IYR(100),IMO(100),IDY(10
1432        10),ELV(100),ELVN(1000),ITEST(1000),KTAPE,NCODE,ICOUNT,IPAGE,IWN(10
1433        10)
1434         DO 28 I=1,IREAD
1435         IF(IREAD.EQ.1) GO TO 1000
1436         IF(NYR(I).EQ.0) GO TO 28
1437         IF(ITEST(NWELL).EQ.1) GO TO 27
1438         DO 25 J=1,NOBS1
1439   C      TEST FOR PIPE ELEVATION CHANGE
1440         IF(NYR(I).GE.IYR(J).AND.NMO(I).GE.IMO(J).AND.NDY(I).GE.IDY(J).AND.
1441        1NWELL.EQ.IWN(J)) GO TO 26
1442      25 CONTINUE
1443         GO TO 27
1444   C      NEW PIPE ELEVATION
1445      26 ELVN(NWELL)=ELV(J)
1446         ITEST(NWELL)=1
1447   C      WATER LEVEL ELEVATION CALCULATED.
1448      27 FL(I)=ELVN(NWELL)-EL(I)
1449   C      OUTPUT WRITTEN ON UPDATED TAPE
1450    1000 WRITE(KTAPE,104)NWELL,NCODE,NMO(I),NDY(I),NYR(I),NTIM(I),EL(I)
1451     104 FORMAT(I4,4I2,I4,F8.2)
1452      28 CONTINUE
1453         RETURN
1454         END
1455   C                    END APPENDIX C
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APPENDIX D.—SOURCE LISTING FOR HYDRAULIC-COEFFICIENT RANGE-ASSIGNMENT PROGRAM

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 1   C                                   APPENDIX D
 2   C
 3   C
 4   C                     HYDRAULIC COEFFICIENT RANGE ASSIGNMENT PROGRAM
 5   C      ***THIS PROGRAM ASSIGNS HYDRAULIC COEFFICIENT RANGE TO EACH LAYER***
 6   C      THIS PROGRAM REQUIRES A SCRATCH TAPE FOR ASSIGNING CODE VALUES TO LAYER
 7   C      DATA
 8          DIMENSION A1(35),A2(15),A3(10),A4(15),STRAT(20,8),A5(15)
 9   C      **THE FOLLOWING CARD READS IN THE NUMBER OF MATERIAL TYPES IN EACH RANGE**
10          READ(5,200)INO,JNO,KNO,LNO,MNO
11      200 FORMAT(5I5)
12   C   ***THE FOLLOWING CARD PUTS RANGE 1 MATERIAL INTO AN ARRAY FOR LOADING***
13          READ(5,101)(A1(I),I=1,INO)
14   C   ***THE FOLLOWING CARD PUTS RANGE 2 MATERIAL INTO AN ARRAY FOR LOADING***
15          READ(5,101)(A2(I),I=1,JNO)
16   C   ***THE FOLLOWING CARD PUTS RANGE 3 MATERIAL INTO AN ARRAY FOR LOADING***
17          READ(5,101)(A3(I),I=1,KNO)
18   C   ***THE FOLLOWING CARD PUTS RANGE 4 MATERIAL INTO AN ARRAY FOR LOADING***
19          READ(5,101)(A4(I),I=1,LNO)
20   C   ***THE FOLLOWING CARD PUTS RANGE 5 MATERIAL INTO AN ARRAY FOR LOADING***
21          READ(5,101)(A5(I),I=1,MNO)
22      101 FORMAT(10F8.0)
23   C   ***THE FOLLOWING CARD READS THE TEST HOLE NO., NO. OF LAYERS AND MATERIAL
24   C      TYPE***
25       10 READ(8,END=1001)NWELL,NOLAY,STRAT
26          DO 1000 I=1,20
27          IF (NOLAY.EQ.0)GO TO 1002
28   C   ***THIS SERIES OF TESTS MATCHES MATERIAL TYPE TO THOSE IN EACH RANGE***
29   C   ***WHEN MATERIAL TYPES MATCH THE RANGE IS ASSIGNED AND STORED ON TAPE***
30          DO 20 J=1,INO
31          IF(STRAT(I,3)-A1(J)) 20,60,20
32       20 CONTINUE
33          DO 30 J=1,JNO
34          IF(STRAT(I,3)-A2(J)) 30,70,30
35       30 CONTINUE
36          DO 40 J=1,KNO
37          IF(STRAT(I,3)-A3(J)) 40,80,40
38       40 CONTINUE
39          DO 50 J=1,LNO
40          IF(STRAT(I,3)-A4(J))50,90,50
41       50 CONTINUE
42          DO 500 J=1,MNO
43          IF(STRAT(I,3)-A5(J))500,501,500
44      500 CONTINUE
45          GO TO 1000
46   C      CODE 1.0, 2.0, 3.0, 4.0, OR 5.0 IS ASSIGNED TO
47   C      RANGE 1.0, 2.0, 3.0, 4.0, OR 5.0 RESPECTIVELY
48   C      RANGE CRITERIA IS DETAILED IN TEXT
49       60 CODE=1.0
50          GO TO 100
51       70 CODE=2.0
52          GO TO 100
53       80 CODE=3.0
54          GO TO 100
55       90 CODE=4.0
56          GO TO 100
57      501 CODE=5.0
58      100 DO 110 K=6,8
59      110 STRAT(I,K)=CODE
60     1000 CONTINUE
61     1002 WRITE(9)NWELL,NOLAY,STRAT
62          GO TO 10
63     1001 REWIND 8
64          ENDFILE 9
```

```
65           REWIND 9
66     1004  READ(9,END=1003)NWELL,NOLAY,STRAT
67           WRITE(8)NWELL,NOLAY,STRAT
68           GO TO 1004
69     1003  REWIND 8
70           WRITE(6,1005)
71     C  ***THE FOLLOWING STATEMENT INDICATES RANGES HAVE BEEN STORED ON TAPE***
72     1005  FORMAT('0DATA ON TAPE')
73           STOP
74           END
75     C                    END APPENDIX D
```

APPENDIX E.—FLOW CHARTS AND LIST OF VARIABLES FOR PREPARING GRAPHICAL PRESENTATIONS
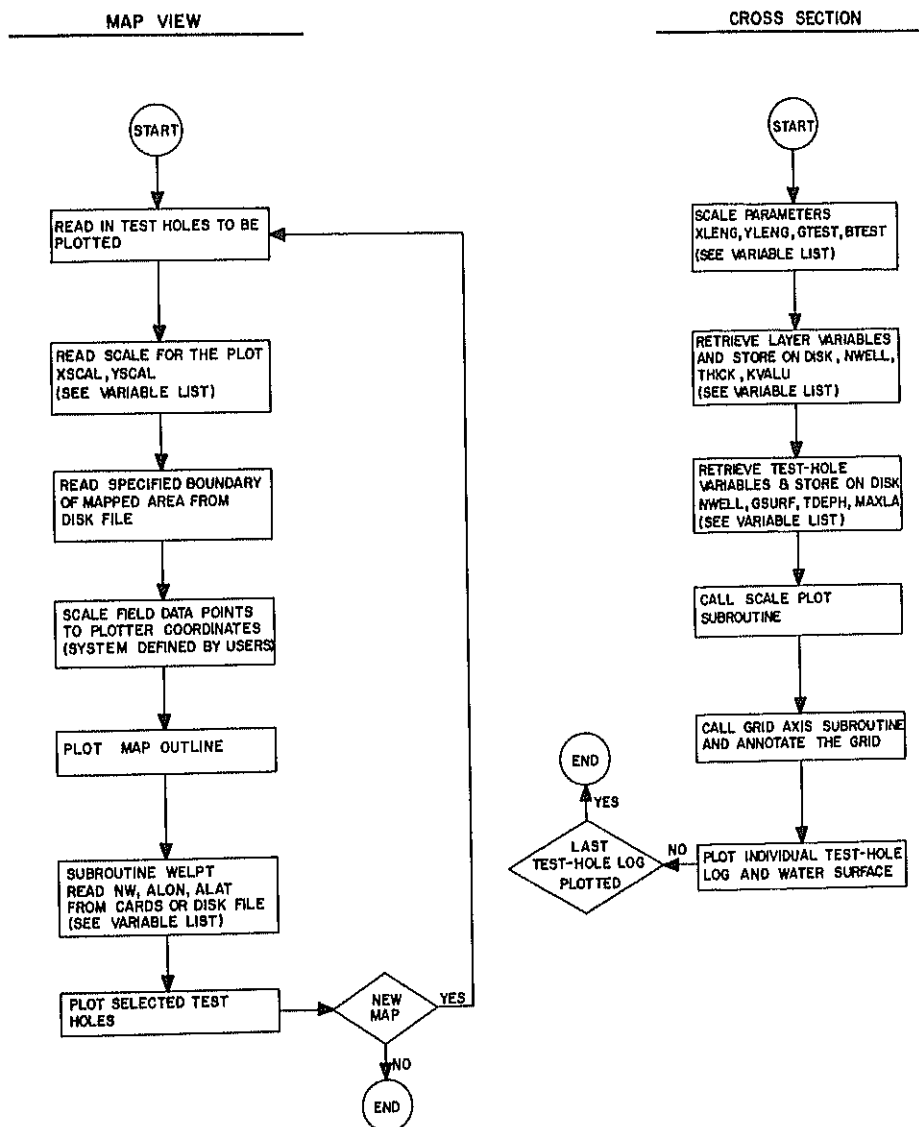
Flow Charts

FIGURE E-1.—Flow charts for preparing map views and cross sections.

List of Variables

Variable name	Format	Description of variable

Boundary Card for Cross Section

Variable name	Format	Description of variable
XLENG	F10.0	Distance in inches between test-hole-log plots.
YLENG	F10.0	Length in inches of the cross-section plot.
GTEST	F10.0	Reference ground-surface datum from which logs are measured on the plot.
BTEST	F10.0	Lower reference bedrock datum beneath which test-hole logs do not extend.

Lithology Card for Cross Section

Variable name	Format	Description of variable
NWELL	I4	Test-hole numbers of logs used in cross section.
IVAR	I4	Layer number for lithology of test holes in cross sections.
THICK	F9.1	Thickness of lithologic layers in feet.
KVALU	F9.1	Hydraulic-coefficient range (1-5) of the lithology in each layer.

Test-Hole Card for Cross Section

Variable name	Format	Description of variable
NWELL	I8	Test-hole number for each log in cross section.
GSURF	F12.3	Ground-surface elevation (feet above mean sea level) for the top of each log.
TDEPH	F12.3	Total depth of each test hole.
MAXLA	I2	Number of lithology layers in each test hole in cross section.

Ground-Water-Elevation Card for Cross Section

Variable name	Format	Description of variable
HWELL	I5	Test-hole number.
HCODE	I2	Code indicating the method of measurement of ground-water level (1=continuous recorder, 2=manual tape down).
NYR	I3	Year when water surface was recorded.
NMO	I3	Month when water surface was recorded.
NDY	I3	Day when water surface was recorded.
NTIM	I5	Time (military) when water surface was recorded.
ELEV	F8.2	Ground-water-surface elevation (feet above mean sea level) in the test hole. One card per test hole.

Location Card for Map Views

Note: four maps are plotted: distributive map, subdatum map, hydraulic-coefficient map, isopachous map.

Variable name	Format	Description of variable
NW	F12.3	Test-hole number for each hole plotted in map view.
ALON	F12.3	Longitude in degrees, minutes, seconds of test-hole locations.
ALAT	F12.3	Latitude in degrees, minutes, seconds of test-hole locations.

Lithology Card for Subdatum Map

Variable name	Format	Description of variable
NW	I3	Test-hole number of each test hole that penetrates the specific datum plane.
ISUB	I5	Elevation of the datum plane to be plotted (feet above mean sea level).
IDEPH	I4	Depth below ground surface to the top of the lithologic layer in which specified datum plane lies.
ELTOP	F8.2	Elevation of the top of the lithology layer that contains the specified datum plane (feet above mean sea level).
RANGE	F12.4	Range of hydraulic coefficients (1-5) at the specified datum.
THICK	F12.4	Thickness in feet of the lithology layer found at the specified datum.
DAPLT	F12.4	This variable name is assigned to the range of K, S, or T to be plotted.

Test-Hole Card for Map View

Note: four maps are plotted: distributive map, subdatum map, hydraulic-coefficient map, isopachous map.

Variable name	Format	Description of variable
NW	I5	Test-hole number.
THVAR	F5.0	Variable THVAR may be any of the 21 test-hole variables used for plotting.

Net-Thickness Card for Isopachous Map

Variable name	Format	Description of variable
WELL NO.	A10	Descriptive literal field.
NW	I6	Test-hole number.
NET THICK	A10	Descriptive literal field.
THICK	F13.0	Net thickness in feet of lithologic layers having the selected hydraulic-coefficient ranges.

Variable name	Format	Description of variable	Variable name	Format	Description of variable
Net-thickness Card for Isopachous Map—Continued			Card for Hydraulic-Coefficient Map—Continued		
CODES	A6	Descriptive literal field.	AKVAL	F5.0	Permeability averaged for all layers in the test hole, gpd/ ft² of aquifer. The size of the fields containing hydraulic coefficients may be altered to accommodate retrieved data.
CODE (I)	5F4.0	Number (1–5) of the ranges of hydraulic coefficients, that is, K, S, or T, to be plotted.			
			ASVAL	F5.0	Storage coefficient, dimensionless value.
Card for Hydraulic-Coefficient Map			ATVAL	F11.0	Transmissibility, gpd/ft of aquifer.
NW	I4	Test-hole number.			

TEST-HOLE CARD FOR CROSS SECTION

VARIABLE / TYPE / PLOT	COLUMN	NWELL 1-8	GSURF 13-24	TDEPH 25-36	MAXLA 44-45
CROSS SECTION		x	x	x	x
DISTRIBUTIVE MAP					
SUBDATUM MAP					
HYDR.-COEF. MAP					
ISOPACHOUS MAP					

GROUND-WATER-ELEVATION CARD FOR CROSS SECTION

VARIABLE / TYPE / PLOT	COLUMN	NWELL 1-5	NCODE 6-7	NYR 8-10	OWN 11-13	NDY 14-16	NTIM 17-21	ELEV 22-29
CROSS SECTION		x	x	x	x	x	x	x
DISTRIBUTIVE MAP								
SUBDATUM MAP								
HYDR.-COEF. MAP								
ISOPACHOUS MAP								

GROUND-WATER ELEVATIONS IN EXAMPLE PLOT WERE RETRIEVED FROM MAGNETIC TAPE STORAGE FOR USE AS CARD INPUT TO PLOTTER PROGRAMS

BOUNDARY CARD FOR CROSS SECTION

VARIABLE / TYPE / PLOT	COLUMN	XLENG 1-10	YLENG 11-20	GTEST 21-30	BTEST 31-40
CROSS SECTION		x	x	x	x
DISTRIBUTIVE MAP					
SUBDATUM MAP					
HYDR.-COEF. MAP					
ISOPACHOUS MAP					

LITHOLOGY CARD FOR CROSS SECTION

VARIABLE / TYPE / PLOT	COLUMN	NWELL 1-4	IVAR(I) 5-8	THICK 9-18	KVALU 19-23
CROSS SECTION		x	x	x	x
DISTRIBUTIVE MAP					
SUBDATUM MAP					
HYDR.-COEF. MAP					
ISOPACHOUS MAP					

BLANK CARD FOR CROSS SECTION

USED IN CROSS-SECTION PLOT ONLY

BLANK CARD INDICATES END OF LITHOLOGIC DATA AND START OF TEST-HOLE DATA

FIGURE F-1.—Input cards for plotting cross sections.

NET-THICKNESS CARD

VARIABLE / TYPE PLOT \ COLUMN	WELL NO. 1-10	NN 11-16	NET THICK 17-26	THICK 27-39	CODES 40-45	46-51	CODE(1) 52-55	CODE(2) 56-59	CODE(3) 60-63	CODE(4) 64-67	CODE(5) 69-71
CROSS SECTION											
DISTRIBUTIVE MAP											
SUBDATUM MAP											
HYDR.-COEF. MAP											
ISOPACHOUS MAP	X	X	X	X	X	Y	X	X	X	X	X

Ranges 1, 2, 3, 4, and 5, APE USED IN THIS EXAMPLE

HYDRAULIC-COEFFICIENT CARD

VARIABLE / TYPE PLOT \ COLUMN	NN 1-4	AKVAL 5-9	ASVAL 10-14	ATVAL 15-25
CROSS SECTION				
DISTRIBUTIVE MAP				
SUBDATUM MAP				
HYDR.-COEF. MAP	X	X	X	
ISOPACHOUS MAP				

FIELDS ON THIS CARD MAY BE VARIED TO FIT DATA ATVAL NOT USED IN THE SAMPLE

LOCATION CARD FOR MAP VIEW

VARIABLE / TYPE PLOT \ COLUMN	ISTOR(1) WEST HOLE NN 1-12	ISTOR(4) LONGITUDE ALON 13-24	ISTOR(3) LATITUDE ALAT 25-36
CROSS SECTION			
DISTRIBUTIVE MAP	X	X	X
SUBDATUM MAP	X	X	X
HYDR.-COEF. MAP	X	X	X
ISOPACHOUS MAP	X		

CARD CONTAINS TEST-HOLE-NUMBER LONGITUDE AND LATITUDE OF EACH DATA POINT

LITHOLOGY CARD FOR SUBDATUM MAP

VARIABLE / TYPE PLOT \ COLUMN	NN 1-3	ISUB 4-8	IDEPH 9-12	ELTOP 13-20	RANGE 21-32	THICK 33-44	DAPLT 45-56
CROSS SECTION							
DISTRIBUTIVE MAP							
SUBDATUM MAP	X	X	X	X	X	X	X
HYDR.-COEF. MAP							
ISOPACHOUS MAP							

TEST-HOLE CARD FOR MAP VIEW

VARIABLE / TYPE PLOT \ COLUMN	ISTOR(1) TEST HOLE 1-5	ISTOR(1) 6-10
CROSS SECTION		
DISTRIBUTIVE MAP	X	X
SUBDATUM MAP	X	X
HYDR.-COEF. MAP	X	X
ISOPACHOUS MAP		

THE VARIABLE ISTOR(I) MAY BE ANY OF THE 21 TEST-HOLE VARIABLES DESCRIBED PREVIOUSLY

FIGURE F-2.—Input cards for plotting map views.

55

```
504 2 70 5 I4 I346 I020.I0
  A B  C  D  E    F      G                        GROUND-WATER-
                                                 ELEVATION  CARD

      504.000    I037.300    43.000    6.000
         A           B          C         D
                                                   TEST-HOLE CARD

                                                   BLANK CARD

      504   I  8.00   2.00
        A  B    C       D
                                                   LITHOLOGY  CARD

             I,     20.     I080.    940.
             A      B         C        D
                                                   BOUNDARY CARD
```
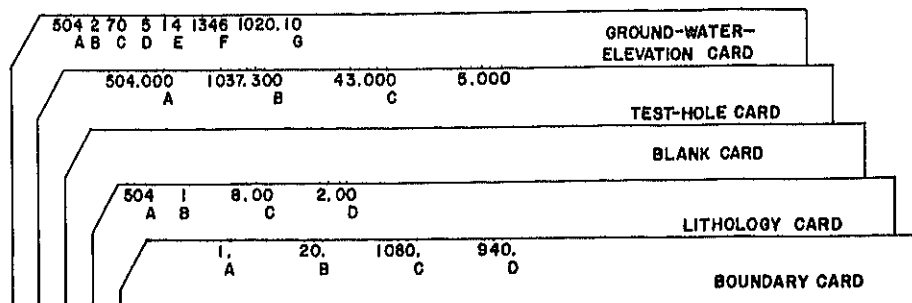
FIGURE F-3.—Input-card setup for plotting cross sections.

```
504 43
  A   B
                                              TEST-HOLE DATA CARD

      504 000  974839.000   345751 000
         A         B            C
                                                 LOCATION  CARD
```
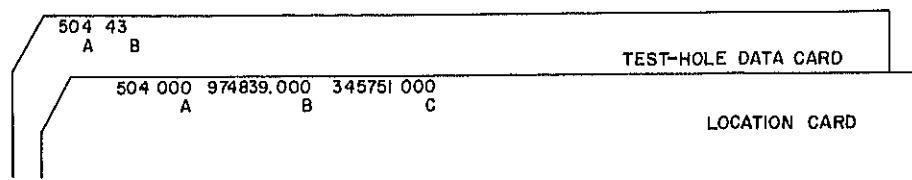
FIGURE F-4.—Input-card setup for plotting test-hole data (see figure 10).

```
5I9 I080 70 I096 50      4.0000    23 0000      4.0
 A   B   C    D            E          F          G
                                              LITHOLOGY DATA CARD

      5I9.000  98I205 000   350327.000
         A         B            C
                                                 LOCATION  CARD
```
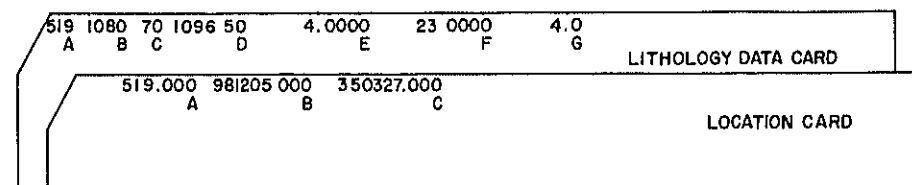
FIGURE F-5.—Input-card setup for plotting data at a specified subdatum
(see figure 12).

```
504 293 0 003
  A   B   C                                      HYDRAULIC-
                                               COEFFICIENT  CARD

      504 000  974839.000   345751.000
         A         B            C
                                                 LOCATION  CARD
```
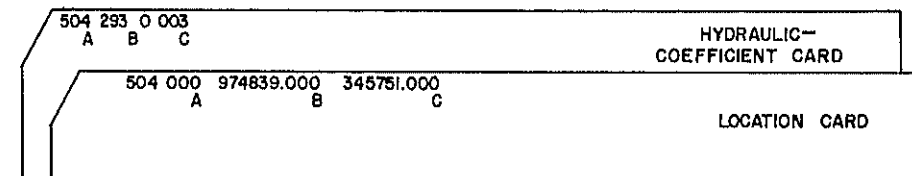
FIGURE F-6.—Input-card setup for plotting average permeability coefficients
(see figure 14).

```
WELL NO.   504 NET THICK        24. CODES    I.  2.  3.  4   5.
   A         B     C              D    E      F   G   H   I   J
                                               NET-THICKNESS CARD

      504.000  974839.000   345751.000
         A         B            C
                                                 LOCATION  CARD
```
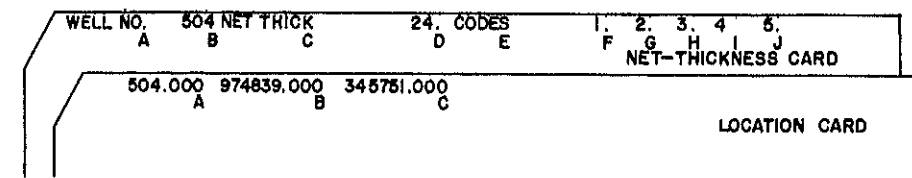
FIGURE F-7.—Input card setup for isopachous maps (see figure 16).